

CLIMATE CHANGE AND AGRICULTURAL PRODUCTION IN ZIMBABWE THE CASE OF ZAKA RURAL DISTRICT IN MASVINGO PROVINCE OF ZIMBABWE

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Abstract

Climate change is a major global challenge and is fast becoming an existential crisis for the universe and the greatest issue confronting humanity today. The impact of climate change on rural livelihoods in developing countries is a growing concern, particularly in sub-Saharan Africa, where most of the population relies on agriculture for food and income security. Extreme weather events, including heat waves, droughts, torrential rains that cause flash floods, high winds and hailstorms, are becoming more frequent in Zimbabwe, which is vulnerable to these variations in temperature and precipitation. The changing climate poses a serious threat to communities in rural areas where they rely mainly on farming, fishing and other traditional livelihoods. Climate change threatens agricultural productivity in Zimbabwe's food-insecure regions, particularly in regions IV and V. Global climate change has been attributed to several sources, including natural and human-caused events. It was clear that the effects of climate change on Zaka District's agricultural and rural people were having an impact on the security of food and income. Communities in rural Zimbabwe like Zaka in Masvingo Province,

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where people depend mostly on farming and other traditional livelihoods, are seriously threatened by the changing environment. Climate change affects different areas of life including the agriculture sector, therefore it has become a concern for development which requires collective action from the government as well as the private sector. Climate change is now widely acknowledged to be true and a wealth of data indicates that it poses a serious threat to development, particularly in developing nations. In Zaka District, the negative consequences of climate change on rural lives and agriculture were already apparent. Indirect effects on local populations' income and food security included decreased access to water supplies, animal losses and agricultural yield reductions. Climate-resilient practices such as crop diversification and conservation agriculture were effective in mitigating risks, but financial constraints hindered adoption. The study concludes that there is need for targeted strategies to enhance adaptive capacity and promote sustainable agricultural development amidst climate change. Recommendations include implementing comprehensive data collection systems, facilitating knowledge-sharing platforms and establishing partnerships with local government agencies, non-governmental organisations (NGOs) and other stakeholders. These measures aim to enhance resilience and promote sustainable agricultural practices in Zaka District.

Keywords: *climate-smart agriculture and climate-smart conservation*

INTRODUCTION

Globally, climate change issues have occupied a central position in debates regarding agricultural productivity. Climate change and the impacts it manifests are becoming glaring day by day in

Zimbabwe. Climate change-induced challenges are not addressed in the long term because households are coping by working within the constraints of their current resources and expectations to achieve specific short-term goals. Climate change has become a challenge from days immemorial, especially for smallholder farmers. This is because small-scale farmers rely on rainfall which has, in the past, been irregular due to changes in the climate conditions, hence causing low harvests. Agriculture is the backbone of most rural areas, unfortunately, these areas have received a huge blow from climate change as crops and animals on which women largely depend, are destroyed by floods and droughts. Concern over how climate change may affect rural lives in developing nations is growing, especially in sub-Saharan Africa where most people depend on agriculture for their food and financial security. One such region that has felt the negative consequences of climate change is the Zaka District in southern Zimbabwe, resulting in lower agricultural productivity and greater vulnerability among its rural populace.

The detrimental effects of climate change on agriculture and rural life are already evident in the district. Reduced access to water supplies, animal losses and lower agricultural yields were among the indirect repercussions on the economic and food security of the local community. Essentially, this study contends that climate change has an adverse effect on agricultural productivity. This has, therefore, prompted the research to contribute to the growing body of knowledge on climate change and its far-reaching implications on farmers in the Zaka rural district, Masvingo Province and nationwide.

CONCEPTUAL FRAMEWORK

WHAT IS CLIMATE CHANGE?

Climate change can be a natural process where temperature, rainfall, wind and other elements vary over decades or more. For millions of years, the world has been less warm and cooler than it is now. But today we are experiencing rapid warming from human activities, primarily due to burning fossil fuels that generate greenhouse gas (GHG) emissions. Climate change is the result of changes in weather patterns due to changes in the earth's average temperature or global warming. Climate change is a broad term. It refers to long-term changes in climate, including average temperature and rainfall. Climate change in the Intergovernmental Panel on Climate Change (IPCC) usage refers to any change in climate over time, whether due to natural variability or as a result of human activity.

WHAT IS CLIMATE SMART CONSERVATION?

Climate-smart conservation is a new way of thinking about protecting the environment, one that plans for how changing climate affects conservation efforts. Climate-smart conservation is about developing and implementing solutions that are effective under a range of potential futures.

CLIMATE-SMART AGRICULTURE

Climate-smart agriculture (CSA) is an integrated approach to managing landscapes, cropland, livestock, forests and fisheries addressing the interlinked challenges of food security and accelerating climate change. Climate change and natural catastrophes have a substantial influence on the agriculture sector, making it more difficult for women to earn a living and provide

food and nourishment for their families. It has a large negative impact on agricultural productivity and activities. Specifically, low-input farming systems, like subsistence farming in Sub-Saharan Africa's developing nations, have been particularly affected by climate change in recent years. Africa's farming industry faces a threat from climate change. In general, the effects of climate change have resulted in lower harvests and greater production costs, which have an impact on the quantity, quality and price of agricultural products in particular regions of Africa. This phenomenon is also common in regions of Asia where its effects have negatively impacted agricultural productivity. Climate change and associated stressors influence human development through their support or destabilisation of the livelihood systems of the poorest and most vulnerable people. There is now broad scientific consensus that climate change is unavoidable.

The global climate has been changing due to GHG emissions, according to reports from the Intergovernmental Panel on Climate Change (Mupfawi, *et al.*, 2023:50). Due to this evolution, Africa is facing several challenges including water stress, low yields from rain-fed agriculture, high levels of food insecurity and malnutrition, rising sea levels and an increase in desert and semi-arid territory. Currently, there are over 690 million hungry people in the world (FAO *et al.*, 2020). Simultaneously, a growing number of individuals globally, particularly young people, are advocating for climate change action. As a result, it becomes increasingly important to address how to attain food security while simultaneously mitigating climate change and cutting down GHG emissions. Most countries in Sub-Saharan Africa (SSA) rely heavily on agriculture for employment and food security for their

economies. The sector also has large numbers of smallholder farmers, most of whom produce under unfavourable conditions characterised by low and erratic rainfall and poor soils. In Zimbabwe, climate variability and change have been of concern and these have caused a decline in agricultural production, which ultimately hamper national food security (Brown *et al.*, 2012). According to the Food and Agriculture Organisation (FAO) (2022), Zimbabwe has experienced a notable decrease in food security and agricultural production over the last 30 years. This decline has also been observed in the agriculture sector's contribution to GDP, which has decreased from over 30% to less than 20% between 2000 and 2020 (Runganga and Mhaka, 2021).

Smallholder farmers in the Southern African region are facing unprecedented challenges in pursuit of increased production under increased climate change and variability. Agriculture plays a huge role in Africa's economy with about 70% of the continent's population practising subsistence farming for their livelihoods in the rural areas. Agriculture remains a key sector of the economy of Zimbabwe, providing livelihoods to more than 70% of the population and supplying raw materials for the predominantly agro-based economy. Land degradation, climate change, loss of biodiversity and ecosystem services pose significant challenges for the majority of the people who derive their livelihoods from agriculture. The agriculture sector in sub-Saharan Africa accounts for about 30% of the gross domestic product (GDP) and 40% of exports in the region (Calzadilla *et al.*, 2013). According to Udemezue and Osegbue (2018), the role of the agriculture sector in economic growth and development includes contribution to GDP, foreign exchange earnings through export of surplus output, direct and indirect generation of employment on farms and agro-

processing industries, forward and backward integration with the industrial and other sectors, food and nutrition security, rural development, poverty reduction and reduction in inequalities between urban and rural areas, to avoid food deficits and imports of food. In a similar vein, empirical agronomic studies in Zimbabwe have shown that climate change harms the agricultural performance of major crops. Pereira (2017) emphasizes that key impacts of climate change include changes in rain patterns, increased evaporation rates, higher temperatures, increased pests and diseases and changes in diseases and pest distribution ranges, reduced yields and spatial shifts in optimum growing regions.

Agriculture has historically been the mainstay of Zimbabwe's economy. The majority of the farming communities are smallholder farmers who depend on rain-fed agriculture, residing in marginal agro-ecological areas, where rainfall is low and unpredictable with lack of technology such as irrigation to curb these climatic effects. Drought is predominant in Southern Africa with Zimbabwean farmers experiencing drought once every two or three years. Conditions are likely to worsen as a result of changes in the local climate. The primary source of income for nearly 68% of Zimbabweans who live in rural areas is agriculture (ZIMSTAT, 2017; Lachaud *et al.*, 2018). The Government of Zimbabwe has pushed for increased agricultural production to meet the goals of the Vision 2030 Agenda, which calls for Zimbabwe to become an upper-middle-income country by 2030 (Government of Zimbabwe, 2021). Zimbabwe remains highly dependent on food imports and aid due to food and nutrition insecurity at household and national levels, even after several programmes were implemented, including *Operation Maguta*, the Reserve Bank of Zimbabwe Agricultural Mechanisation Scheme,

the Zimbabwe-Brazil More Food for Africa, Command Agriculture and *Pfumvudza*. Zimbabwe's economy is agro-based depending mainly on rain-fed agriculture and any development is pinned to a successful rainfall season. The country's agricultural sector is essentially stagnant, leading to food shortages and a reliance on food imports. Therefore, an increase in agricultural production will boost the country's GDP. In addition, Zimbabwe has limited capacity to adapt and cope with the negative impacts of climate change due to low income, lack of technologies, poor infrastructure and weak institutions.

Climate change, is a new danger that has surfaced recently that threatens the growth of the agricultural sector, the creation of sustainable livelihoods, the fight against poverty and national and family food security in Zimbabwe and other emerging nations. The 2030 Sustainable Development Agenda aims to eradicate poverty in all of its manifestations by the year 2030 (FAO, 2017). But even as we approach 2030, a lot of people's lives are still plagued by poverty. According to the United Nations Development Programme (UNDP) (2023), 1.1 billion people worldwide, including 485 million living in severe poverty, remain multi-dimensionally poor across 110 nations. Projections of climate change indicate that the semi-arid tropics will become drier, with increased temperatures and increased frequency of droughts. Zimbabwe's agricultural production is characterised mainly by the relatively low productivity of a small selection of staple cereal and legume crops (including maize, sorghum, millet, beans, groundnuts and soya beans). (Hunter *et. al.*, 2020). Agricultural measures are needed, especially in rural areas, to address this enduring poverty and accomplish the more general

goals of human well-being and sustainable development. The perpetual droughts and failure to provide sustainable rural agricultural solutions to the rural populace is a big challenge in Zimbabwe and worsened in 2024 by the El Nino-induced drought which affected the whole of Southern Africa. The role of climate resilience livelihoods became increasingly important in ensuring sustainable food and income security in the area of study. Given the current state of climate change, which has a major impact on district's household income levels, this was especially pertinent. This was particularly relevant in the current context of climate change, which significantly impacted on the income levels of households in the district.

Zaka Rural District is located in Agro-ecological Region IV, characterised by an annual rainfall of <650 mm (unimodal rainfall pattern from October to March) and a mean maximum air temperature of 28°C (Manatsa *et al.*, 2020; Madamombe *et al.*, 2024). Climatic conditions in dry land regions are harsh, with high temperatures and low and erratic precipitation. These harsh climatic conditions have been exacerbated by climate change and have caused a reduction in agricultural production, hence chronic food insecurity and long-term drop in agricultural production. In Zaka District, dry spells are experienced during the mid-season which is the most critical phase in farming as it is the crop-growing period. The vegetation in the area is typically semi-arid Savanna, comprising deciduous trees and shrubs interspaced with overgrazed grass. The landscape is relatively flat, with scattered rocky outcrops. The area is suitable for drought-tolerant crops. Farmers in the Zaka area grow various crops, including cereals, legumes, oil seeds and cash crops.

The elevated rates of poverty and restricted availability of resources and data exacerbate the effects of climate change. The majority of households in the study district rely mostly on subsistence agriculture as their source of income, making them highly dependent on natural resources. Their food and income security has, therefore, been severely impacted by weather patterns changing and extreme disasters. The Zaka District Climate Vulnerability Assessment (2023) states that lack of resources and information to assist communities in adapting to the changing climate has made this vulnerability even more severe. The effects of climate change on agriculture have been profound the district . A Food and Agriculture Organisation (FAO) research predicted that by 2050, Zimbabwe's maize yields could drop by as much as 20% due to climate change. In the district, where maize is a staple crop and a significant source of revenue for smallholder farmers, this is a serious problem. Food and economic insecurity worsened as a result of low agricultural yields, with a high rate of undernourishment and malnutrition among the local populace. (Adaptation and Mitigation Strategy for Climate Change in Zimbabwe, 2020).

METHODOLOGY

STUDY AREA

Zimbabwe is one of the SSA countries in the Southern African region. It covers an area of 150 871km² , with arable Land and Permanent Crops data reported at 41 million km² in 2021. Figure 1 shows the agro-ecological zone distribution map identifying the five main climate regions of Zimbabwe.

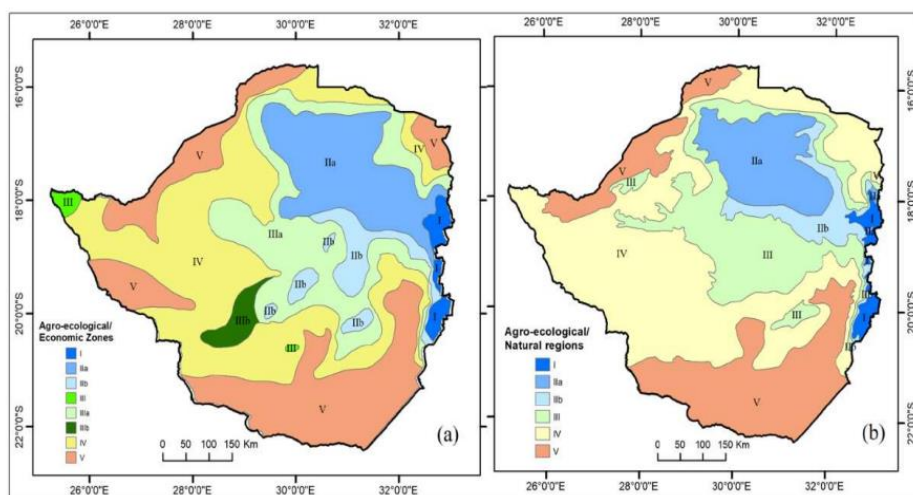


Figure 1: Agro-ecological zones ((a) Vincent and Thomas, 1960); (b) 1984 AGRITEX

Zimbabwe is predominantly semi-arid and is characterised by relatively high agro-ecological diversity with different agricultural systems. The country has diverse climatic patterns, with the eastern highlands receiving more than 1 500mm of rainfall while the southern and western parts of the country are dry and characterised by erratic rainfall of less than 500mm per year (Manatsa, *et.al.*, 2020). The mean annual temperature decreases from about 23°C in the low-lying areas in the south-western parts of the country to about 18°C in the eastern highlands. The diverse climatic pattern is a key determinant of vegetation patterns and soil characteristics. Since the climate is the main determinant of agricultural practice, it is important to delineate geographical regions into homogenous zones where variations in climate determine the agricultural activities practised in these areas.

Up to now, Zimbabwean agriculture has been centred around Agro-ecological Zones/Natural Regions, also known as AEZs or

just Natural Regions (NRs), created in the 1960s by Vincent and Thomas (Vincent and Thomas, 1960). The Southern part of Zimbabwe is prone to frequent droughts caused by inadequate rainfall leading to loss of fodder and food crop productivity. Droughts affect crop farming in natural regions IV and V excessively, of which Zaka Rural District is part of. Evidence indicates that rain-fed agriculture constitutes the main livelihood activity in the selected agro-ecological locations.

One of the main drivers of climate change in Zimbabwe is land degradation resulting from unsustainable land-use practices due to a growing population. Land degradation occurs mainly due to the excessive conversion of woodlands into agricultural and settlement areas to cater for the increasing demand for food and shelter among households. About 70% of the population resides in rural areas of Zimbabwe. The increase in rural population in Zimbabwe means an increasing dependence on agricultural activities to sustain the daily livelihoods of the rural populace.

From a methodological perspective, the use of available secondary data to avail important literature required for climate change research in the SSA region was promoted. It demonstrates a simple way of relating climate variables with economic indicators using existing qualitative approaches. In terms of determining suitable climate change adaptation measures, Stakeholders were consulted to suggest the adaptation measures and propose a practical approach to implement them. The qualitative paradigm was applied to the research. The methodology was selected based on the nature of the subject. Understanding the requirements, issues, interests, attitudes and adaption strategies of small-scale farmers to climate change and agricultural production in

Zimbabwe was crucial to the study. The goal of qualitative research is to comprehend how each person sees the world from his or her unique point of view. To comprehend the social environment, qualitative research focuses on the factors that influence human behaviour, such as internal beliefs, feelings and motives, according to Biklen (2007). Therefore, qualitative research seeks understanding and is more interested in the processes than the results.

FINDINGS AND DISCUSSION

WOMEN AND CLIMATE CHANGE

Climate change in the rural areas seems to affect women largely as they are the ones who fend for the family and make sure there is food on the table for their families. Climate change has, without doubt, become a topical issue around the globe and Zimbabwe has not been spared from this predicament, an idea supported by Brazier (2015) who argues that “Climate change, in the sense of altered long-term changes in the average state of the atmosphere, is already occurring in Zimbabwe”. Another issue brought on by climate change is the lack of water. According to the UEA (2013), water shortage is the inability to supply enough water to fulfil demand. Water is becoming scarce due to the decrease in water supplies brought on by climate change. According to Rosen *et al.* (2009), women in Sub-Saharan Africa are estimated to spend 124 minutes a day getting water for various purposes. When given equal opportunities, women can dramatically increase the productivity and climate resilience of the agricultural sector, enhance community access to and sustainable use of water resources, raise everyone's level of agricultural production, hence food security and spur economic growth. There is evidence from

records since 1900 that the average annual surface temperature has increased by 0.4°C. There are now hotter days and fewer cold days than in the past. The advent of climate change has resulted in a plethora of challenges globally especially in the rural areas which happen to be agriculture-based. Brazier (2015) postulates that:

“Climate change will exacerbate hardship and poverty among the people of Zimbabwe. Women, children and the disabled, especially those living in rural areas, will be the worst affected. The renowned resilience of Zimbabweans will be put to the test to develop effective coping strategies”.

Women are essential for both reducing and adapting to climate change due to their contributions to crucial climate change industries like agriculture. Due to their numerous responsibilities as caregivers, guardians of health and producers of food, women tend to carry a disproportionate amount of the burden of adjusting to climate change, but they are provided with significantly few resources to deal with its effects (UNFCCC, 2019). Climate change exacerbates pre-existing inequalities, vulnerabilities, poverty and unequal power relations. It affects men and women differently because of gender roles and gendered differences in responsibilities, time-use patterns, access to resources and assets, patterns of household and public decision-making and income access and control. Women’s knowledge is a valuable resource for adaptation. In agriculture, women are knowledgeable about sowing seasons, multi-cropping, local crops, trees and herb varieties, wild edible plants, crops suitable to climatic conditions, seed selection, seed storage, preparation of bio-fertilizers, pesticides, manure application, pest management, post-harvest processing and value addition (Lane and McNaught, 2009, UNDP, 2013). Decisions regarding adaptation at the

household level revolve around preparing for or responding to climate risks that affect crops, livestock, household water and energy resources, health and kitchen gardens (that women are usually responsible for) (UN Women 2022:12).

GENDER MAINSTREAMING AND CLIMATE CHANGE

Although it is becoming more widely acknowledged that mainstreaming is crucial for ensuring social justice and human rights for both men and women, it is also important to include gender perspectives in all sectors of development to ensure that other social, economic and environmental goals are successfully attained. Gender-responsive climate policies need to be strengthened much further in all areas connected to adaptation, mitigation and related implementation strategies. Having access to a range of resources, including information, land, cash and transportation, is necessary for climate change adaptation. Consequently, incorporating a gender perspective and acting upon it, including recognising the importance of women in both reduction and adaptation measures, will be necessary for effective climate change adaptation.

The goal of gender mainstreaming is to advance and realise gender equality. Ensuring that gender perspectives and the goal of gender equality are central to all activities such as policy development, research, advocacy/dialogue, legislation, resource allocation and planning, implementation and monitoring of programmes and projects, it entails making women's as well as men's concerns, needs and experiences an integral part of the process. It is a tactic and method employed to help attain gender equality rather than an end in and of itself. One way to make sure that programmes are gender-sensitive and able to track progress

and accomplishments toward addressing gender disparities and having effective, efficient, equitable and sustainable climate action at the same time, is to create guidelines and give all relevant stakeholders enough training on how to integrate gender dimensions into all programme activities, including sectorial plans and the national strategic action plan.

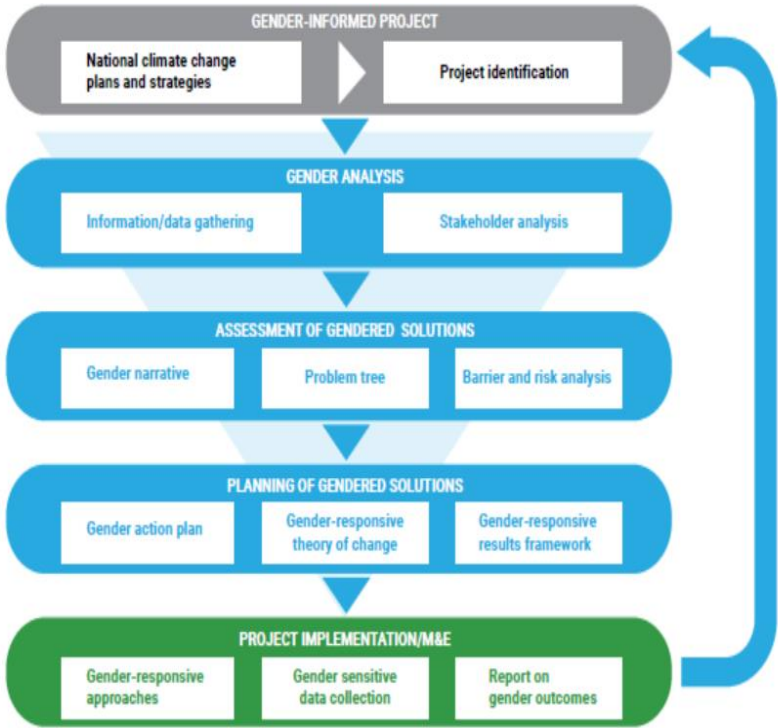


Figure 2: Showing the summary of the importance of gender mainstreaming in climate change. (GCF and UNWOMEN, 2017)

Women stakeholders must be consulted during the design of programmes or projects. Failure to do so may fail to identify and address critical information about their needs and knowledge, which could compromise the project's ability to meet its goals. Determining susceptibility, impacts and adaptation to climate

change hence requires the application of gender-sensitive and participative methodologies and tools.

It is against this background that gender mainstreaming in climate change requires both integrating a gender perspective into the content of different policies, addressing the issue of representation of women and men in the given policy area and institutionalising gender equality in the structure, processes and cultures of organisations implementing these policies. This will also go a long way in minimising disasters in general. It is critical to gender-sensitive strategies in most contexts and is particularly critical to the aspects of women's voice and representation in decision-making for climate change and disaster risk reduction policies and programmes (UN Women, 2021). Empowerment activities can take many forms, such as creating an enabling environment and the development of women's capacities, income and leadership through activities that should not be seen as mutually exclusive but rather as complementary to gender mainstreaming. It is important to note that a gender dimension is adequately mainstreamed at all levels of development planning in Zimbabwe by giving reference to the Zaka rural area.

CLIMATE CHANGE AND VULNERABILITY

Long-term changes in temperature, precipitation and other climate characteristics are referred to as climate change and they place a great deal of pressure on a variety of global sectors, most notably agriculture and livelihoods (Smith *et al.*, 2018). In this context, vulnerability refers to the extent to which people or communities are susceptible to negative consequences resulting from the impacts of climate change. An understanding of vulnerability to climate change is pivotal as it unveils the specific

hurdles confronted by local communities in their quest for improvement in agricultural production.

Moreover, vulnerabilities brought on by climate change are complex and arise from a combination of institutional, environmental and socioeconomic factors (Jones and Patel, 2020). For example, poverty, restricted access to resources and dependence on livelihoods susceptible to climate change can all lead to socioeconomic vulnerabilities. The relationship between geographic exposure to climate risks, including floods or droughts and environmental vulnerabilities, may exacerbate food insecurity and income instability. Weak policy frameworks, insufficient governance structures and a restricted ability to effectively manage climate risks can all lead to institutional vulnerabilities (Garcia and Nguyen, 2019). Designing context-specific interventions that support climate-resilient livelihoods and improve agricultural production and economic security for vulnerable individuals requires an understanding of these linked vulnerabilities (Brown and Kim, 2021). By addressing the root causes of susceptibility and enhancing adaptive capacity, communities can become more resilient to the negative effects of climate change and maintain their way of life over time.

For decades, rain-fed agriculture has not only sustained agricultural production and food security for many Zimbabweans, but has also contributed immensely to the country's industrialisation. Prolonged droughts and other shocks brought on by climate change and variability, however, have severely affected traditional farming methods, particularly in the semi-arid districts of Zaka Rural District. These methods include extensive cattle ranching, semi-pastoralism, cultivating rain-fed crops like

maize, millet and sorghum, crop rotation and intercropping, using little to no commercial inputs like fertilizers and hybrid seed, and growing farmers' seed.

In general, the low-income rural households in Zaka rural areas that rely on rain-fed agriculture face several risks, strains and vulnerabilities brought on by socioeconomic, political, environmental and climatic factors. Their capacity to create assets, accumulate capital and generate steady income is compromised by these unfavourable circumstances and poor levels of climate change adaptation. The study's conclusions show that local agricultural productivity is adversely impacted by climate change. The main climatic factors influencing agricultural practices are increased rainfall, extended droughts and extremely high temperatures. The majority of people living in the Zaka Rural District noted altered rainfall patterns, with a significant number emphasizing the negative impacts on agriculture. This is aligned with existing literature that emphasizes the vulnerability of agricultural systems to changes in precipitation patterns (Lobell *et al.*, 2011; Smith *et al.*, 2019). Increased rainfall leads to waterlogging, soil erosion and crop diseases, highlighting the importance of adaptive strategies such as drainage systems and crop diversification. The observed changes in rainfall patterns, characterised by both excessive precipitation and prolonged dry spells, highlight the vulnerability of agricultural systems to erratic weather conditions. Excessive rainfall can lead to waterlogging, soil erosion and increased incidence of crop diseases, posing significant challenges to crop cultivation and yield stability.

The research discovered that high temperatures can induce heat stress in crops and livestock, leading to reduced productivity and

increased susceptibility to diseases and pests. Prolonged droughts were identified as a major concern among farmers, with a higher percentage acknowledging its severe impact on agricultural activities. This corroborated previous research indicating that droughts posed significant challenges to food security and livelihoods, particularly in arid and semi-arid regions (Dai, 2013; Mirzaei *et al.*, 2020) and Zaka Rural District is not an exceptional case. Some of the negative impacts of climate change experienced in Zaka Rural District were: the emergence, spread and distribution of livestock diseases, increased drought frequency, prevalence of parasites and diseases that affect livestock and the shift in the seasons, has made it difficult for the farmers to adhere to their normal planting dates, hence leading to poor agricultural production.

CLIMATE CHANGE AND FOOD SECURITY

Climate change has been a challenge from days immemorial, especially for smallholder farmers. It has impacted crop yields, the nutritional quality of main cereals and livestock productivity in Zimbabwe. In Zimbabwe, an increase in temperature slows down plant growth and leads to a decrease in the expected yield of plant growth. The delayed start of the rainy season and mid-season dry spells have heavily impacted crop and livestock production. This is because small-scale farmers rely on rainfall which has, in the past, been irregular due to changes in climate conditions, hence causing low harvests. Climate change has also led to frequent recurring floods and cyclones. Various cyclones occurred in Zimbabwe due to its geographical location of being adjacent to the coastal Mozambique hence, experiencing a series of cyclones and tropical storms including Cyclones Eline in 2000, Japhet in 2003, Dineo in 2017, Idai 2019,

Batsirai in 2022, as well as tropical storms Chalane in 2020, Eloise in 2021 and Ana in 2022. Currently, Zimbabwe is also suffering from the effects of El Niño which affected the whole of Southern Africa. In some areas it caused drought and in others, heavy rain. Southern Africa is experienced a particularly brutal El Niño season, with one of its driest Februarys in 40 years and widespread crop failures.

The governments of Zimbabwe, Zambia and Malawi all declared national disasters due to El Niño-linked droughts. The changing rainfall patterns, flash floods and frequent droughts affected both livestock and crop yields. Jamba (2020) notes that in Zimbabwe, there was intense crop failure and livestock death due to excessive heat waves. Therefore, crop and livestock production is projected to decline due to the increased negative impacts of climate change which include droughts, heat waves and floods. Nearly 690 million people around the world are hungry today (FAO *et al.*, 2020). At the same time, more and more people around the planet, including youth, are pushing for action on climate change. Thus, the question of how to achieve food security while also adapting to climate change and reducing greenhouse gas (GHG) emissions becomes ever more relevant. Agriculture contributes a significant part of GDP in many economies; 2.5 billion people worldwide depend on agriculture for their livelihoods (FAO, 2016). Climate change has contributed significantly to future food insecurity by raising food prices and decreasing food output. Water for food production is becoming scarcer due to increased crop water use and drought. As certain locations become climatically unsuited for farming, competition for land has intensified. Furthermore, extreme weather events in Zimbabwe linked to climate change produce abrupt decreases in agricultural productivity.

Most farmers in the Zaka rural district reported that climate change has negatively impacted their crop production, with a majority reporting reduced crop yield. The reduction in yields has contributed to food insecurity at household level, reduction in family incomes and high levels of poverty among farmers. Farmers are generally experiencing a decrease in household income following extreme weather events and slowing down economic growth and development given the important role that agriculture plays in developing countries, particularly African economies.

CLIMATE CHANGE ADAPTATION AND MITIGATION STRATEGIES

Climate change adaptation and mitigation strategies vary from place to place, even within the same country (Mushore *et al.*, 2021:2). The impacts of climate change in Zimbabwe are likely to be complex and multifaceted, requiring a range of adaptation and mitigation measures to address. Understanding strategies employed in an area is important for the modification and adoption of strategies in other areas. Studies that look at area-specific responses are important for creating a national and global database for climate change adaptation and mitigation strategies. Climate change adaptation has emerged as an answer to the problem. Necessity is the mother of innovation. In Zaka Rural District, farmers are implementing different strategies in their bid to cope with climate change and adapt to the ever-changing weather patterns that affect agriculture. Agriculture encompasses the rearing of animals and growing of crops for consumption as a family or for market purposes where profits are sought. Instead of local farmers relying on crop production as the mainstay of agriculture, they are now resorting to animal husbandry production. They keep animals like goats and cattle on a large

scale as a fall-back if there is poor rainfall during the season due to climate change.

To minimise the negative impact of climate change, afforestation initiatives can also be targeted at sustainably increasing productivity, enhancing resilience and reducing GHGs and require planning to address trade-offs and synergies between these three pillars: productivity, adaptation and mitigation. Sustainable agricultural practices, such as agroforestry and shading techniques, help buffer temperature fluctuations and minimised heat stress in livestock (Rosenzweig *et al.*, 2014; Thornton *et al.*, 2014). Therefore, to achieve food security, there is need to take into consideration the issue of climate change seriously.

Diversification of income sources emerges as a key strategy for enhancing climate resilience among livelihood-dependent populations (Garcia *et al.*, 2020). Relying solely on agriculture for income exposes individuals to significant risks due to climate change-related uncertainties (Jones and Kim, 2017). It is, therefore, essential to diversify sources of income by working outside the farm or looking into other choices for a living (Chen *et al.*, 2021). This approach improves adaptive capacity and overall resilience in addition to reducing the negative effects of climate shocks on agricultural productivity (Nguyen and Smith, 2016). By adopting a livelihoods approach and promoting income diversification strategies, communities can bolster their resilience to climate change and safeguard their food and income security in the long term (Patel and Brown, 2020). Understanding the dynamics of livelihoods and the adaptive measures undertaken by individuals is essential for designing effective interventions that foster

sustainable development amidst environmental uncertainties (Lee and Garcia, 2018).

The use of improved crop varieties and use of small grains is expected to increase average yields because of the greater seed diversity of the same crop as well as the use of sustainable agricultural practices such as agroforestry, mulching, multiple cropping, dry-soil planting and microclimate management techniques offer promising avenues for mitigating the adverse effects of temperature extremes and enhancing agricultural resilience to climate variability.

The findings underscore the urgent need for water management strategies and drought-resistant crop varieties to mitigate the impacts of water scarcity on agricultural productivity. There is also need for local farmers in Zaka, especially those in areas like Chipare, Muzinda and Svuure, to invest in buying irrigation equipment as they reside near Lake Manjirenji. There is also need to refurbish the irrigation scheme in areas around Chipfunde area, as there is a constant supply of water due to the availability of the dam. Destruction of farming infrastructure is an issue of concern about agriculture productivity (Jamba, 2020). Such infrastructure is very critical in supporting agriculture. The destruction means that production in agriculture is affected. The Zaka District Development Fund (DDF) (now the Rural Infrastructure Development Agency [RIDA]) should also consider revamping the already constructed dams, especially on the issue of siltation which is posing a threat to water reservoirs. Prolonged droughts exacerbate water scarcity, affecting both rain-fed and irrigated agriculture and jeopardising food security and livelihoods. The recognition of prolonged droughts as a significant concern among

farmers resonates with existing research indicating the severe consequences of water scarcity on agricultural production. Prolonged dry spells can lead to crop failure, livestock fodder shortages and diminished water resources, amplifying food insecurity and economic vulnerabilities within farming communities. Consequently, there is an urgent need for the implementation of water management strategies, including improved irrigation infrastructure, rainwater harvesting systems and drought-tolerant crop varieties, to enhance resilience to water stress and mitigate the impacts of prolonged dry spells.

Local farmers near sugarcane-producing areas, Hippo Valley and Triangle, are also taking advantage of getting cheap labour from Zaka Rural District. The youth and other able-bodied people from areas like Chekenyere, Dzoro, Chivamba, Feri, Magura, Charingeno and some of the resettled farmers from the Fast Track Land Reform Programme (FTLRP), have resorted to looking for employment in Chiredzi, Hippo Valley and Triangle. Challenges to cope with the effects of climate change have forced some farmers to completely abandon agriculture and focus on other means of livelihoods (Jamba, 2020).

THE ROLE OF INDIGENOUS KNOWLEDGE SYSTEMS AND CLIMATE CHANGE

As previously stated, climate change adaptation and mitigation strategies vary from place to place, even within the same country (Mushore *et al.*, 2021:2). Understanding strategies employed in an area is important for the modification and adoption of strategies in other areas. In rural places like Zaka, the knowledge of local and indigenous peoples, commonly referred to as indigenous knowledge systems (IKS), is crucial for sustainable development.

Indigenous knowledge systems (IKS) are acknowledged by the UN as offering important insights and long-term solutions to combat climate change, and are gradually being recognised as an imperative source of information for climate mitigation and adaptation (Kugara *et al.*, 2022; 1). IKS encompass many knowledge domains, including natural resource management, agriculture, health, spirituality and cultural practices (Pandey and Choudhary, 2021). The knowledge is based on the indigenous peoples' deep understanding of the local ecology, weather patterns and ecosystems, as well as their cultural and spiritual values. Indigenous groups have evolved strategies for adjusting to shifting environmental conditions. These knowledge systems, sometimes referred to as 'village wisdom', are designed to increase sustainability and resilience by emphasizing methods that enable people to deal with erratic weather patterns, shifting seasonal patterns and other climate-related difficulties. The use of IKS has been recognised by many people in African countries as a paramount source of knowledge on climate change and adaptation (Mafongoya and Ajayi, 2017). For instance, to increase resistance to droughts and floods, farmers in Zimbabwe have developed traditional agricultural techniques like crop diversification, water gathering and soil conservation.

The relevance of traditional knowledge in addressing the impacts and adaptation to climate change is acknowledged by the United Nations Framework Convention on Climate Change (UNFCCC). Years of observation, adaptability and fortitude in the face of environmental difficulties have shaped IKS. These unique customs, beliefs, values and knowledge were created by locals based on their interactions with the natural world. IKS have gained increased recognition and importance, especially in

sustainable development, biodiversity conservation and climate change. Indigenous knowledge holders are seen as critical partners in addressing these global challenges, as their knowledge and practices offer valuable insights into living sustainably and in harmony with the environment.

IKS are still not fully integrated into development interventions or policies, leading to a loss of opportunity to advance sustainable development goals. IKS face several challenges, including the erosion of traditional knowledge due to modernisation, the marginalisation of indigenous peoples and the lack of recognition of the value of indigenous knowledge by external actors. Efforts are being made to promote the protection and promotion of IKS, including developing policies and programmes that support the recognition, respect and promotion of indigenous knowledge and practices. Therefore, it is against this background that the use of IKS in climate change should not be undermined.

CONCLUSION

Sub-Saharan Africa is considered to be highly vulnerable to climate change-related disasters, particularly drought. The frequent severe droughts in this region have heavily affected the growth of the agriculture sector, forcing crop and livestock farmers to work under very dry conditions in countries such as Zimbabwe. Drought negatively affect the number of undernourished people as the quantities of crop yields, for example, maize as the staple food crop in Zimbabwe, are reduced. Climate change is one of the most pressing challenges of our time, posing existential threats to humanity and the natural environment. Effective management of climate change-induced challenges requires localised strategies that may vary from one

part of the world to another and even within a country. Therefore, climate change is indeed a shared responsibility where everyone matters, but it is also vital to recognise those who are most impacted by this global phenomenon. As seen and proven once again through this study, the impacts of climate change are not the same but they affect vulnerable women the most. The findings show that climate change has a significant negative impact on livelihoods and agricultural production, hence compromising the food security status of smallholder farmers in Zaka Rural District. The identified climate change adaptation strategies implemented in the study area included food aid, the use of traditional grains and other drought-resistant crops, early planting, multiple planting, barter trade and livelihood diversification. The mitigation strategies used included afforestation and reforestation programmes, avoiding veld fires and preservation of wetlands. It is strongly recommended that initiatives related to climate change adaptation and agricultural production need consideration of strategies to increase resilience and adopt better methods of coping with the challenges being faced. Climate-smart agriculture is also being embraced globally as an approach to transform and protect the agriculture sector.

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