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Climate change adaptation strategies among livestock herders in the Mutoko District of Rural Zimbabwe

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Abstract

In many developing countries, livestock play a crucial role in improving the standard of living for poor rural households. However, the lack of, or failure to adopt, effective and modern climate change mitigation and adaptation techniques can have a significant negative impact on productivity. Livestock herders, especially the smaller ones, in developing nations are particularly vulnerable due to their locations and the socioeconomic situations of these countries. Their lack of resources makes it difficult for them to adapt to this threat. The various adaptation strategies employed by farmers in rural Zimbabwe are prone to contribute to a significant reduction in livestock loss and consequently poverty alleviation. This study employed a qualitative method wherein thirteen participants from four villages of Mutoko District took part. Participants were selected through purposive sampling and data was collected through in-depth interviews and analysed through thematic content analysis. The study found that a wide array of strategies has been put in place in order to deal with the loss of cattle in the district. These strategies include improved grazing management practises, provision of medical facilities such as disease control precaution, diversification of livestock, and adoption of improved/stress-tolerant livestock.

Keywords: Adaptation; Climate change; Drought; Livestock herders; Rural Zimbabwe

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1. Introduction

Over a billion people worldwide rely on livestock systems, which support diverse cultural, economic, lifestyle and employment opportunities. A majority of the world's livestock herders reside in rural areas of developing countries in Africa and Asia (Herrero et al., 2013). Most poor households in African and the south Asian countries rely heavily on livestock as a source of income (Thornton et al., 2009; Mugambiwa, 2020). Livestock provides both a source of investment with increased liquidity for risk minimization and a source of rich nutrition. Landless and small-scale livestock herders in rural areas rely heavily on their cattle for revenue, but in this age of rapidly shifting climates, they face an array of new dangers (Mugambiwa, 2020).

Increasing demand from urbanization and population growth and adverse climatic shocks that disrupt livestock productivity present significant problems for the world's livestock systems (Thornton et al., 2009). Poor quality feed and a higher prevalence of livestock diseases are already known to magnify the negative effects of climate change on livestock productivity (Bett et al., 2017). The occurrence and poor control of livestock diseases, which result in heavy livestock losses, are influenced by a number of factors, such as inadequate access to veterinary services, poor knowledge, and suboptimal living conditions, to mention a few (Bernabucci, 2019). Further, animals that are less adaptable to climate change have been severely harmed and have even lost their lives due to flooding and sporadic droughts (Dublin and Ogutu, 2015). Facing these challenges, low-income rural households often lack the financial resources to implement the latest adaptation solutions (Faisal et al., 2020). They often find it difficult to get support from local institutions, however, even if they are able to gain access to institutional treatments, the quality of such services may be degraded, resulting in worse outcomes.

Given that agriculture is the primary source of income for the majority of smallholder farmers, it is crucial to analyse coping mechanisms in order to strengthen the agriculture sector's resilience (Faisal et al., 2020). Recent research conducted on a global and national scale has concentrated on several facets of how smallholder farmers manage climate stress. For example, several studies have examined the ways in which livestock herders increase and strengthen their capacity for adaptation by adjusting their livestock production in response to climate variability (Bett et al., 2017). The impact of climate change on agriculture, current efforts by the government and farmers to adapt, analysis of how cyclones affected farmers, development of an activity-based adaptation index, and smallholder farmers' changing attitudes toward adaptation are all factors that influence the choice of coping strategies.

Despite numerous reports of climate change's negative effects on agriculture, particularly crop production, there is a paucity of research examining how this phenomenon will affect livestock breeding (Seo and Mendelsohn, 2007). Water, soil, and coastal areas are particularly vulnerable to the effects of climate change (Barnett et al., 2007), and as a result of climate change, growing zones will shift, and the distribution of weeds, diseases, and pests will change as well. A warmer and wetter climate is likely to change the composition of forage, make conditions more favourable for the spread of livestock diseases and pests, and increase the number of animals lost due to heat stress (Collier and Zimbelman, 2007). Climate change poses a serious threat to livestock production, especially in light of the continued increase in atmospheric concentrations of greenhouse gases and the recent worldwide occurrence of record warm global temperatures.

In Africa, agricultural drought is already having a negative impact on livestock and agricultural production (Mugambiwa, 2021). Due to their scant resources and weak coping mechanisms, many farmers in Sub-Saharan

Africa are susceptible to agricultural drought (Herrero et al., 2013). Farmers use a variety of coping mechanisms to deal with agricultural drought. Small holder farmers use coping methods, usually temporary corrective efforts, to survive when an unforeseen agricultural drought strikes, and their livelihoods are threatened. Mugambiwa (2021) found that coping mechanisms are actions and activities carried out within already-existing structures and systems, and the use of various coping mechanisms decreases economic and social vulnerability. These tactics include making good use of abilities, looking into chances to counteract the effects of agricultural drought, and managing resources both during times of drought and during regular seasons (Faisal et al., 2020). More adaptable coping among farmers is facilitated by factors related to education, information resources, community resources, neighbourly support, and social network involvement.

The efficiency of adaptation to climate change, including agricultural drought, in many instances depends on local and extra-local institutions that organise incentives for both individual and communal action. Existing institutions have a significant impact on how rural communities have adapted to environmental issues historically and they are also the key mediating mechanisms that will translate the impact of future external interventions to support climate change adaptation (Bernabucci, 2019). Future policy development related adaptation must take historical experience and understanding of adaptation possibilities into account. This is due to the fact that the specifics of climate change consequences are yet unknown, despite the fact that it is obvious that the overall effects will be severe and long-lasting if current trends continue.

The purpose of this study is to explore climate change adaptation strategies in rural Zimbabwe with a qualitative interview protocol and participation by a number of small livestock herders. The objectives of the paper are to present livestock herder views and perspectives on effective coping strategies, challenges, and the community initiatives they are using, or they believe will help mitigate and prepare their farms as climate change brings increased disease, drought, and economic hardship to the region. The paper is designed to explore, qualitatively, the value and likelihood of livestock diversification, breeding, and conservation farming methods, which are all expected to play a greater role in rural Zimbabwe in future.

2. Research methodology

An exploratory qualitative research design was employed for this study in the Mutoko District of rural Zimbabwe. Rahman (2016) suggested that results from a qualitative approach are not readily reduced to numbers using standard statistical methods, but instead the goal of a qualitative study is to interpret and learn more about real-world occurrences and experiences. Shields and Rangarjan (2013) emphasised that exploratory research is done to help define broad research problems prior to more in-depth analysis. Although climate change adaptation research is not a new phenomenon, a fresh perspective on the topic has been provided in this study examining climate change adaptation strategies among livestock headers.

All livestock headers in the Mutoko District of Zimbabwe constituted the population of the study. Participants were recruited from the villages of the district using a criterion purposive sampling strategy. Criteria purposive sampling, as defined by Bryman (2012), entails selecting units for the sample on the basis of specific characteristics that will aid in the study's exploration and comprehension of its aims and objectives. The researcher visited participants in their homesteads seeking permission to take part in the study. The researcher clarified that participation in the study was voluntary and they were free to withdraw at any stage. Also, the researcher clarified that there were no financial benefits for taking part in the study. All households

in the district kept one or more types of livestock, however the author was more interested in headers who predominantly kept cattle. Therefore, thirteen (13) participants were chosen using criterion purposive sampling to participate in in-depth interviews. The interviews were tape recorded and transcribed verbatim. Thematic Content Analysis (TCA) was used to examine, analyse, and report on data patterns as defined by Braun and Clarke (2006). The data was examined for trends and patterns, which were then coded and categorized by the researcher.

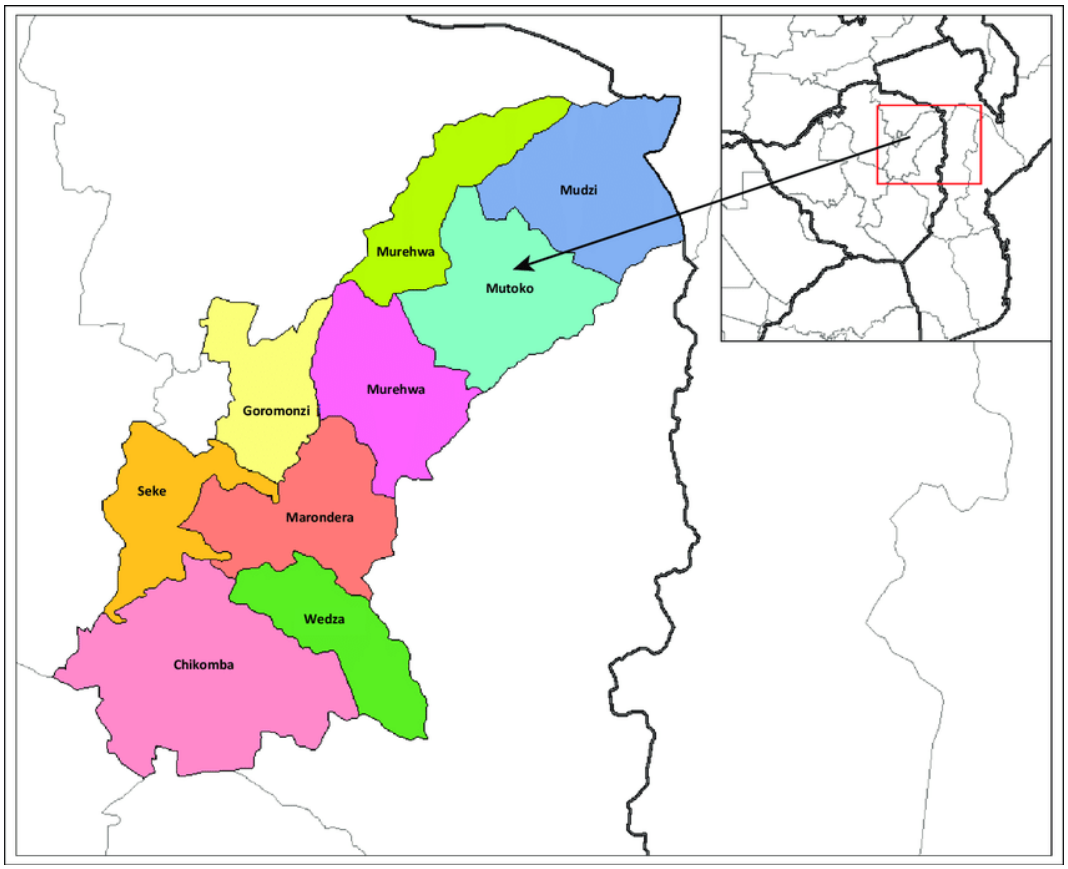

Figure 1. Map of Mutoko District (Source: https://doi.org/10.4102/jamba.v10i1.388)

3. Findings and discussion

3.1. Livestock farming in Mutoko District

The study interviews revealed that livestock farming is rarely considered a sole activity in Mutoko District. Rather, livestock farming is conducted in conjunction with other agricultural activities such that none of the participants were livestock producers. A majority of the participants were both livestock herders and subsistence farmers. The foundation of subsistence farming in Mutoko is conservation farming. In order to retain moisture, improve soil fertility, strengthen soil structure, lessen soil erosion, and limit disease presence, conservation farming employs natural ecological processes. Fanelli and Dumba (2011) asserts that

conservation farming enhances soil structure and lessens erosion in three different ways. These include crop rotation, crop residue retention, and low soil disturbance. Small grains (sorghum and millet), maize, groundnuts, sunflower, and small-scale cotton production are the principal crops farmed in the district, which is dominated by rain-fed agricultural cultivation.

Most livestock herders in the district keep cattle, goats and sheep. These animals are significant in subsistence farming and subsistence economy generally. The majority of villages cultivate their own food on a local scale, while occasionally surpluses are sold to augment household income, especially with cotton output recently declining due to decreased prices brought on by economic hardship and inflation. Smallholder farmers have turned to the selling of dryland crops, such as tobacco production, and horticulture as some of their most important sources of revenue when the region receives enough rainfall. The area's farmers frequently engage in horticulture, and they specialise in producing tomatoes, onions, green vegetables, butternuts, and cucumbers. Crop production is not feasible in most locations without irrigation due to the high temperatures in the region. So, raising livestock is a secondary widespread practise in the region, with farmers specialising in raising cattle, sheep, goats and poultry (Moyo, 2016). In order to supply their cattle with water, those who employ irrigation for farming syphon water from large rivers, seasonal ponds, and shallow wells.

3.2. Cattle loss

The findings of this study revealed that communities in Mutoko District have been impacted by the loss of livestock, particularly cattle, as a result of a series of droughts. Consequently, farm output suffered, and more people experienced food insecurity. One participant had this to say;

> *"We have experienced droughts on numerous occasions and the most notable ones are 1992, 2002 and 2008. Some droughts may not be famous but the fact that almost every year we experience water shortages means that drought has become a common phenomenon in our communities. The famous droughts we experienced in the past resulted in severe cattle loss which resulted in widespread hunger in the community because we also use cattle for ploughing our fields through ox drawn cultivators".* (Participant 2, livestock herder, Nyamuzizi Village)

The participant revealed that the loss of cattle due to drought resulted in severe economic challenges since communities significantly rely on cattle for agricultural purposes. The loss of cattle therefore is a serious threat to food security in the community. Another participant emphasised the impact of cattle loss on food security:

> *"Despite the fact that we haven't lost cattle due to drought in the recent past, the major challenge we encounter as a result of drought is loss of the means of livelihood that is sufficient food for our families. The most notable drought that I remember where we lost cattle was the 2008 drought where a majority of small holder farmers reportedly lost a number of cattle. Recently, in 2019 there was a drought, but it wasn't severe."* (Participant 5, Livestock herder, Matedza Village)

The participant emphasised that food insecurity is the major challenge resulting from cattle loss in the community. This is due to the community's reliance on cattle for ploughing purposes and milk production. Hassan (2010) asserts that climate change significantly threatens livestock output since the consequences of climate change can be seen in all aspects of agriculture, including agricultural production and animal

husbandry. In addition, Oseni and Bebe (2010) studied the methods and techniques that Kenyan farmers use to reduce their vulnerability and build their resilience. Many communities in Zimbabwe have lost livestock, particularly cattle, as a result of a series of droughts.

Figure 2. Drought killed over 19000 cattle in Zimbabwe (2016) (Source: https://thisisafrica.me/politics-and-society/zimbabwe-drought-kills-over-19-300-cattle/)

Figure 2 shows a cow that died due to drought in rural Zimbabwe. In 2016, Zimbabwe was struggling with a drought crisis that resulted in the deaths of approximately 19 000 cattle (Chatora, 2016). The government was incapable of supporting cattle owners; instead, it urged them to sell their cattle, but few people were willing to purchase animals that were close to passing away.

3.3. Key Adaptation Strategies

A wide array of strategies was put in place as a response to the drought in order to deal with the loss of cattle in the district. These strategies include improved grazing management practises, diet supplementation, bran feeding, provision of medical facilities such as disease control precaution, diversification of livestock, and adoption of improved/stress-tolerant livestock. To be effective, any livestock mortality prevention programme must first identify the causes of livestock deaths and then take action to prevent them, whether that action is taken by farmers themselves or by external institutions (Kauppinen et al., 2012).

Livestock herders in Mutoko District are vulnerable because they do not have access to most of the world's sophisticated adaptation options. Their vulnerability is compounded by the fact that they are unable to counteract the negative consequences of their geographical and socioeconomic circumstances, and their lack of resources only serves to exacerbate the situation (Maskrey et al., 2007). People living in rural areas who lack proper ex-ante risk management skills and ex-post coping capacity are particularly at risk (Faisal et al.,

2020). As a result of continuing climate change, it is anticipated that the cattle business will be particularly vulnerable. Nevertheless, in order to cope with the aforementioned challenges, livestock herders in Mutoko District use a combination of Indigenous Knowledge Systems (IKS) and Western methods to adapt to the loss of livestock as shown in Table 1.

Table 1. Rural climate change adaptation strategies to help prevent livestock loss determined in this study

Strategy	Explanation
a) Adoption of stress-tolerant livestock	Farmers are adopting improved and stress-tolerant animal breeds.
b) Diversification of livestock	Farmers are involved in keeping a variety of livestock breeds such as goat and sheep breeds that develop quicker than indigenous breeds.
c) Disease control precaution	Farmers are making use of veterinary services in order to ensure the prevention and management of animal diseases
d) Improved grazing management practises	Farmers are making efforts to reduce overgrazing, enhancing forage supply, and boost plant and animal variety. Grazing management strategies aim to maximise livestock productivity and sustain fertile grasslands.

3.3.1. Adoption of stress-tolerant livestock

Farmers are using short and long-term tactics to respond to and manage climate-related hazards while utilising a combination of on-farm and off-farm strategies to adapt to the changing climate. Some of these tactics include improving agronomic methods, adopting improved and stress-tolerant animal breeds, income diversification, modifying cropping patterns, adopting improved crop varieties, and transitioning to new crops. Many respondents revealed that they now largely consider the use of stress tolerant cattle breeds such as Brahman and Mashona cattle breeds. For example:

> *"Past experiences of cattle loss have taught us a lesson that we need to adopt stress tolerant breeds so that we minimise losses in the event that there is a drought. The adoption of these breeds was advised by non-governmental organisations and we have also learnt from one another in the villages. The most common breeds that we currently have is Brahman and Mashona",* (Participant 7, Livestock herder, Nyamuzizi Village)

Most participants revealed that communities are aware of the impact of climate change on climate loss, and as a result they are well prepared to counter the loss. The adoption of the specific cattle breed in the community is recommended by non-governmental organisations and social networks, which are also considered essential since community members are learning from one another. Birachi et al. (2020) asserted the adoption of stress

tolerant breeds is essential in preventing cattle loss during climate-related catastrophes, such as drought. The authors further suggested that other tactics include arranging livestock migrations and using climate data and indigenous knowledge to help farmers decide what to plant and when to grow their crops.

3.3.2. Diversification of livestock

This study has established that participants have resorted to the diversification of livestock to help offset climate-related losses. Instead of only keeping cattle, communities in the region also maintain poultry, goats and sheep. The various breeds of cattle mentioned earlier in this study are also a form of livestock diversification. One participant reiterated;

> *"Droughts pose severe threats of losing livestock hence we have resolved to keeping a variety of animals. Here I specialise more on cattle, but I also keep goats and sheep. And in my backyard as you can see, I have chickens that I have had for over two years now and I get some money largely through selling eggs. Having a variety of animals serves as a back-up for us in case some our animals (Zvipfuyo) are affected by natural disasters such as droughts we still remain with something."* (Participant 10, Livestock herder, Chibeta Village)

A majority of participants revealed that they have a variety of animals in order to prepare for unexpected disasters. These animals, which include sheep, goats and poultry, have also been considered a gateway to food security. In support of this finding, Radeny and Ayal (2019) is of the view that farmers in Kenya have adopted Red Maasai sheep and Galla goat strains that develop quicker than indigenous breeds, are resistant to internal parasites, have better feed efficiency, and can withstand trypanosomes, drought, and heat stress. Different sheep and goats were among the improved small ruminant livestock supported. Improvements in livestock management techniques went hand in hand with the introduction of these livestock breeds.

3.3.3. Disease control precaution

Disease control precaution has been established to be a significant adaptation method. Livestock herders in the district have over the years made use of the services of veterinary professionals from government veterinary centres. The veterinary centres are in charge of, among other things, early detection and quick reaction to outbreaks of new or resurgent animal diseases. Robertson (2019) asserts that a fundamental tenet of veterinary epidemiology is that disease follows specific patterns, i.e., it tends to occur more frequently in specific categories of a population, at particular times, and in particular regions. Identification of these patterns, risk factors that increase the chance of disease, and risk variables that decrease the likelihood of disease is essential to disease control so that actions can be taken to lessen the frequency, severity, and effect of disease. Developed countries have better access to long-term climate and disease data, socioeconomic dynamics, and pathways for disease transmission than developing countries (Patz et al., 2005).

3.3.4. Improved grazing management practises

The planning, implementation, and oversight of animal grazing are all components of grazing management, which aims to produce long-term benefits for animals, plants, land, the environment, and the economy under

a variety of environmental circumstances. Communities in Mutoko District have embarked on various strategies of managing grazing land. For instance, one herder put it this way:

> *"One of the strategies we have employed in order to reduce overgrazing is the creation of paddocks that have various compartments. We therefore allow our animals to graze in certain compartments for some time while allowing other compartments to grow sufficient grass for grazing such that when the grass is particularly low, we transfer the animals to other compartments in order to allow the other compartments to recover."* (Participant 12, Livestock herder, Matedza Village)

By reducing overgrazing, enhancing forage supply, and boosting plant and animal variety, grazing management strategies aim to maximise livestock productivity and sustain fertile grasslands. When properly managed, grazing enables the maintenance of healthy grasslands, the financial viability of cattle enterprises, and the growth of other plants and animals. Well-managed grazing practises can undo harm and support the health of grasslands. Experience, education, and access to institutional resources all help with climate change adaptation. Their improved knowledge, education, and awareness of climate change force them to adopt advantageous practises. These outcomes are in line with what we anticipated in this study, and those of other similar research efforts (Nabikolo et al., 2021). Compared to their peers in Nyamuzizi and Chidye villages, livestock herders in Matedza and Chibeta were less likely to implement strategies for reducing the effects of climate change. Because of this, it appears that the herders of livestock in Nyamuzizi were more concerned about the implications of global warming. It is not surprising that the research identifies a few key traits thought to be essential to easing the adaptation process in rural areas, especially in the cattle sector.

In the Mutoko District, livestock and rural economies were expected by most participants in this study to suffer as a result of actual and future climate change. There has been little research on how climate change adaptation can lower poverty and livestock losses. Some of the most important adaptation strategies used in the district include improved feeding, medical facilities, diversification of livestock, and adoption of stress-tolerant breeds. Clearly, these communities have decided that adjusting for climate change is preferable and will help minimise livestock losses.

4. Conclusion

The study used a qualitative interview format with rural livestock herders in Zimbabwe to show that climate change adaptation among livestock herders faces a wide array of challenges. The findings of the study revealed that a number of internal and external factors influence adaptation decisions. It has been established that the developing world, such as Mutoko District, lack the funds to make many desirable adjustments, and people frequently live in remote areas with little access to basic institutional services such as extension programs, veterinary facilities and medical expertise. Also, a majority of the study respondents were not knowledgeable about disease emergence, persistence, and spill-over that led to cattle losses. Hence, the main conclusion of this research is that new strategies for the identification, response, and control of infectious diseases should be created. The adoption of the specific cattle breed in the community is recommended by non-governmental organisations and social networks, which are also considered essential since community members learn from

one another. The adoption of stress-tolerant breeds was also found essential in preventing cattle loss during climate-related catastrophes, such as drought.

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