



**SMALLHOLDER LIVESTOCK FARMING UNDER CLIMATE STRESS:
FARMER PERCEPTIONS, INSTITUTIONAL CONSTRAINTS AND ADAPTATION
PATHWAYS IN BEITBRIDGE DISTRICT, ZIMBABWE**

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ABSTRACT: *This paper examines the experiences of smallholder livestock farmers in Beitbridge, a primarily arid agroecological district in Zimbabwe, as they navigate the challenges posed by climate change and adapt their livestock management practices accordingly. It uses a mixed-method research design, largely shaped by farmer perceptions and attitudes. The study also draws on insights from scholarly literature to explore the country's limits and constraints to climate change adaptation and the coping strategies and resilience-building measures farmers employ. The research highlights the critical role of institutional arrangements, such as government policies and support mechanisms, in shaping the capacity of smallholder farmers to adapt to climate variability and extreme weather events effectively. The findings revealed that livestock farmers often confuse local bylaws with formal policy guidelines, with the result that some tragically view climate change as 'an act of God,' leading to a sense of helplessness and detachment and a reluctance to adopt climate-smart livestock practices. The study emphasizes the need for education and training on livestock resilience building among smallholder farmers. It calls for further research on the effects of climate change on livestock farming in particular, cattle value chains.*

KEYWORDS: Climate change, climate variability, livestock climate adaptation, institutional arrangements, climate-smart practices.



INTRODUCTION

Climate change significantly threatens agricultural productivity and food security in Zimbabwe, where the economy relies heavily on climate-sensitive sectors like livestock and crop farming¹. Smallholder farmers, who constitute approximately 70 percent of the rural population, are particularly vulnerable to the impacts of climate change due to their limited access to resources, information, and institutional support.² Sub-Saharan Africa, especially Southern Africa, is increasingly vulnerable due to the compounding effects of poverty, chronic food insecurity, and environmental degradation.³ In arid regions of Zimbabwe, where 90% of the population relies on rain-fed agriculture, livestock production is crucial in sustaining livelihoods.⁴

While livestock production systems have historically contributed to food and nutrition security in arid regions of Zimbabwe over the past 30 years, recent trends show declining productivity, including among indigenous breeds. This decline is driven by deteriorating grazing conditions, poor-quality pastures, and seasonal water shortages that affect both livestock and crop farmers. Climate variability—particularly recurrent droughts—has further intensified these challenges, severely disrupting livestock production systems. Moreover, limited capacity for climate adaptation and mitigation, compounded by weak institutional support at both the community and national levels, has exacerbated the situation.

Livestock production is highly vulnerable to climate change due to its effects on feed resources, temperature fluctuations, water availability and disease prevalence.⁵ Climate change alters the quantity, quality and spatial-temporal distribution of feed resources, impacting livestock nutrition and overall productivity. In mixed smallholder farming systems, feed sources typically include grazed biomass from rangelands, crop residues and, to a lesser extent, forages and concentrates.⁶ Each of these feed resources is affected differently by climate change, influencing livestock performance and sustainability.

Smallholder farmers rear livestock for multiple purposes beyond meat and milk production, including insurance, banking, socio-cultural and crop-supporting functions such as manure production and traction.⁷ In these systems, herd size often holds greater significance than individual animal productivity. However, maintaining excessively large herds can compromise efficiency in milk and meat production. Climate change and adaptation strategies may impact these diverse livestock functions in different ways. Yet there remains limited knowledge on how these effects unfold in smallholder systems, highlighting the need for further research.

Smallholder livestock farming in Beitbridge is predominately dependent on rain-fed agriculture. This system's primary output is for household consumption, with a minimal surplus for reinvestment or expansion.⁸ The small surplus that is produced contributes marginally to household income. However, low productivity, exacerbated by the depletion of productive assets and insufficient climate mitigation and adaptive capacities, continue to challenge livestock farmers, many of whom are hesitant to adopt climate-smart livestock management practices.⁹ The ongoing depletion of productive assets, such as livestock, land, soils, water, implements, labor, and knowledge, has created a vicious cycle of poverty, increasing dependency on external humanitarian assistance.¹⁰



Furthermore, weak institutional arrangements for climate mitigation and disaster risk reduction at the village, ward, district, provincial, and national levels have failed to support resilience-building in livestock farming management in Zimbabwe.¹¹ As a result, smallholder livestock farmers remain vulnerable to climate-related disasters, underscoring the need for concerted efforts by all stakeholders to develop effective mitigation and adaptation strategies that promote resilient livestock farming practices. Scholars further note that smallholder farmers' resilience can be enhanced by providing context-specific information for effective decision-making and for selecting and implementing strategies toward climate-smart agriculture.¹² Currently, Beitbridge suffers from uncertainties and knowledge gaps on the likely effects of climate change and adaptation options around livestock farming. It is evident that community resilience to climate threats in these farming communities has significantly deteriorated over time.

This paper thus, posits that understanding the interplay between the smallholder livestock systems, climate mitigation, adaptation, and the role of institutional support in Zimbabwe is critical for building resilient agricultural systems. The article examines the capacity of livestock farmers to mitigate and adapt to climate change and variability. It also evaluates policy responses and explores institutional arrangements to develop effective strategies for climate change mitigation and adaptation in the livestock sector.

RESEARCH METHODOLOGY

The study was conducted in the communal wards of Beitbridge Rural District in Matabeleland South Province, Zimbabwe (see Figure 1). Figure 1 illustrates the spatial position of Beitbridge District, highlighting its proximity to international borders and key ecological zones relevant to climate and livelihood vulnerability. It covers 12,697 square kilometers and consists of 15 wards, with an estimated population of approximately 23,000 households.¹³ Situated in agro-ecological region V, Beitbridge is one of the driest districts in Zimbabwe, characterized by low and erratic rainfall. The district receives an average rainfall of 250-450 mm per season. Despite these harsh climatic conditions, Beitbridge remains one of Zimbabwe's leading cattle-producing regions.¹⁴ However, livestock farming has received limited attention in regional policy frameworks on climate change adaptation.¹⁵

In addition to cattle, other livestock species that thrive in the district include goats, sheep, donkeys, and pigs. The area also supports wildlife conservation, with several game parks and ranches, including the renowned Greater Mapungubwe Transfrontier Conservation Area.¹⁶



The study employed three qualitative data collection tools: a household questionnaire, Key Informant Interviews (KIIs), and Focus Group Discussions (FGDs). The household questionnaire was designed to gather information on socio-economic characteristics of individual households, their practices and challenges related to climate mitigation and adaptation, as well as their knowledge of institutional arrangements. It also captured the farmer's suggestions for improving climate mitigation and adaptation strategies for livestock in the district. Interview guides were prepared to align with the study's objectives. These tools were pretested in the Beitbridge area prior to actual data collection, and necessary adjustments were made based on the pretest results. Two FGDs were held with livestock farmers in each ward, ensuring equal representation of male and female participants. The discussions were held in the local indigenous languages (Venda, Sotho and isiNdebele) and moderated by agricultural extension officers with extensive local experience. In addition, in-depth interviews were conducted with ten key stakeholders, including members of the local community, representatives from the Beitbridge Rural District Council, government departments such as the Department of Livestock, local leaders and non-governmental organizations.

RESULTS AND DISCUSSIONS

The key findings on respondents' understanding and practices related to climate mitigation and adaptation in livestock farming, as well as the institutional arrangements supporting these adaptive strategies, are presented below. This study first examines the concept of mitigation, followed by adaptation, and finally, the institutional frameworks in place to support livestock farmers in the face of climate change. Recommendations are provided for all relevant stakeholders.

Demographics

The study initially targeted 158 respondents from eight wards in the Beitbridge District. However, due to various factors, including time constraints on the part of the respondents, 100 individuals ultimately participated. Of these, 62% were males and 38% were females. The majority of the respondents fall within the economically active age group, indicating strong participation of working-age (15-62 years) individuals in the study. (Table 1).

Table 1: Age distribution of respondents

Age range (Years)	Percentage (%)
Below 15	2
15-30	24
31-46	27
47-62	31
Above 62	17
Total	100

The challenges livestock farmers face in Beitbridge District may be partly explained by the fact that women, who are often not fully empowered, and young men are primarily responsible for looking after livestock after largely male migration to South Africa. The elderly in these communities have, to some extent, lost their traditional role as key advisors; few people consult



them, despite their wealth of indigenous knowledge, which could positively impact modern society.

Most respondents attained secondary education (48%), suggesting a moderate level of literacy that may influence awareness and adoption of climate mitigation strategies. 33% attained primary education (see Table 2). Several studies have found the level of education to be an important factor in farmers' adaptive capacities and their willingness to embrace, absorb and apply new information (Belay et al., 2017; Alemayehu et al., 2017; Mdoda, 2020). The study aimed to determine whether the level of education significantly influenced climate change awareness, practices, and the farmers' approaches to mitigation and adaptation in response to climate change. Further details are provided in the subsequent sections of this paper.

Table 2: Education levels of respondents

Education level	Percent (%)
Never attended school	16.0
Primary education	33.0
Secondary education	48.0
Tertiary education	1.5
Vocational education	1.5
Total	100

Livelihoods are largely dominated by agriculture-related and informal employment, underscoring vulnerability to climate-related shocks. The occupations of respondents included casual laborers in the agricultural sector, civil servants, domestic workers and self-employed individuals. The majority of respondents (36%) were employed as casual laborers, while a small portion (4.4%) held managerial positions in farms, extension services, and the manufacturing and retail sectors (see Table 3).

Table 3: Occupational Distribution of respondents

Occupation	Percent (%)
Casual agricultural workers	36
Civil servants	18
Domestic workers	20
Managers	4.4
Self-employed	22
Total	100.0

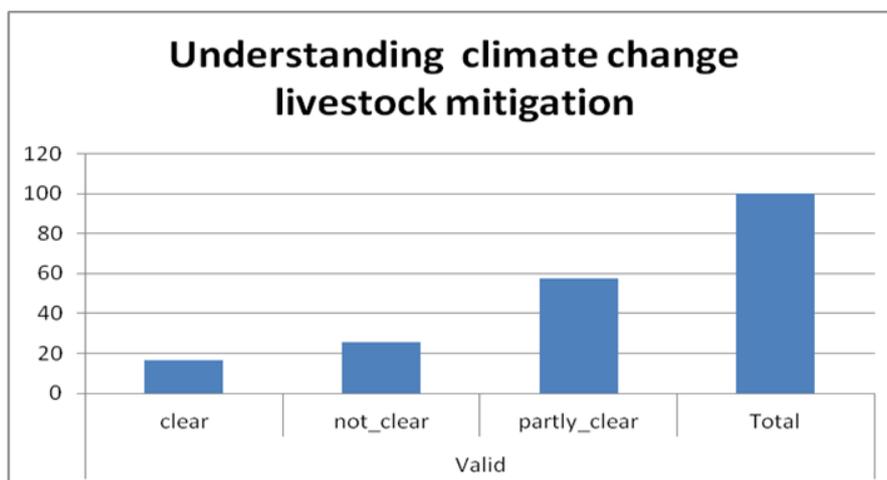
Respondents' occupations gave insights into their incomes beyond that sourced from livestock sales and also indicated whether they were prepared to invest their earnings in building up a viable livestock industry. The 22% 'self-employed' were either full-time livestock farmers or did extra work to complement whatever income they obtained from their livestock business. The majority of the 20% domestic workers were 'herd boys' or 'cattle herders'. Farmers employ a lot of young men to look after their animals.

Local Farmers' Understanding of Climate Change Mitigation

The respondents' understanding and appreciation of livestock climate change mitigation strategies were often incorrect or unclear. Some confused mitigation with adaptation, while 58% demonstrated partial understanding of how to mitigate the impacts of climate change and variability on their livestock (Figure 2). Only 18% of the respondents, mostly those with higher levels of formal education, appeared to grasp the seriousness of climate change on their livestock farming. This group actively engaged with ward-based AGRITEX and veterinary officers on best practices such as regular watering and supplementary feeding, especially during critical periods of pasture and water shortages.

On the other hand, 24% of the respondents lacked any understanding of the concept of mitigation. These farmers relied on traditional semi-pastoral practices, moving their livestock annually toward the Shashi and Limpopo rivers on the borders with Botswana and South Africa. Unfortunately, this annual migration often resulted in significant livestock losses due to fatigue, disease, water stress, predation by wild animals, deteriorating pastures, and theft by organized criminals.

Figure 2: Farmers' level of Understanding of Climate Change Livestock Mitigation Measures



The figure shows respondents' awareness and understanding of livestock-related climate change mitigation strategies. Fifty-eight percent of the farmers indicated that they were aware of national climate change policies and familiar with the mitigation methods promoted by the District Extension Officers. However, closer examination revealed that what they regarded as climate change policies were by-laws meant to promote health, and that what they understood as climate change policies were actually by-laws aimed at promoting public health, healthy animal breeding, and curbing livestock theft. They mentioned regulations such as animal



branding, regular dipping, livestock taxes or dipping fees, and livestock clearance by the Veterinary Office and local police during animal movement, along with mandatory vaccinations against certain diseases. These farmers also reported adopting small grain cropping, participating in awareness campaigns organized by farmer groups, and practicing destocking as climate change mitigation strategies.¹⁸

Despite this, many farmers expressed concerns about middlemen who buy their livestock at low prices, and some suspected the involvement of local police in facilitating livestock theft for personal gain. Although regular dipping is mandated by the bylaws, farmers pointed out that dipping chemicals are often unavailable, leading to increased tick infestations in the district. Twenty-seven percent of farmers, who recognized the need for urgency in mitigating climate change, mentioned that they do not wait for government support. Instead, they purchase dipping chemicals themselves by selling a few animals to reinvest in their breeding operations.¹⁹

Key Climate Mitigation Strategies

Driving Livestock to National Parks and Conservancies: 40% of farmers resorted to driving cattle and donkeys into national parks and conservancies along the borders with Botswana and South Africa. This strategy likely helps mitigate overgrazing in communal lands but may contribute to conflicts over resource use in protected areas (see Figure 3).

Lack of Paddocking and Degraded Grazing Infrastructure: There was no mention of paddocking, and farmers highlighted that communal grazing fences and former white-owned farm paddocks were vandalized decades ago. No efforts to resuscitate these grazing management practices were observed, neither from farmers nor the government.

Low Use of Fodder or Stover: Fodder and stover use was not widely practiced, possibly due to limited cropping by most farmers. Without access to supplementary feed, livestock may become more vulnerable to food shortages during droughts.

Limited Early Warning Systems: Only 3% of farmers received climate early warning messages from the Civil Protection Department through their phones, indicating limited access to critical information for proactive livestock management.

NGO and Government Initiatives: Farmers were aware of efforts by the FAO, private cattle buyers, and NGOs, along with government extension workers (AGRITEX and Livestock Development Programme), to implement comprehensive livestock climate mitigation measures.

However, these initiatives were reported as politically manipulated, with only those connected to political elites benefiting. A notable example cited was the distribution of weaners and heifers, where the politically connected received priority.

Environmental Degradation: Field observations showed significant environmental degradation, including overgrazing, soil erosion, siltation of water bodies, and deforestation. These issues exacerbate the vulnerability of livestock farming in the district and undermine mitigation efforts.

Challenges and Institutional Arrangements



Traditional Leadership and Livestock Management: Traditional leaders, once responsible for controlling cattle movements, monitoring dipping schedules, and facilitating paddocking, appear to have lost control over livestock management. This breakdown in traditional governance further hampers effective mitigation efforts.

Institutional Weaknesses: The politicization of government and NGO initiatives leads to inequitable distribution of resources, with the majority of farmers unable to benefit from potentially helpful livestock mitigation programs.

IMPLICATIONS

This study shows that although communities in Beitbridge have adopted certain adaptation measures, such as moving livestock into wildlife conservancies during periods of stress and acting on early warning information, these responses remain ad hoc, fragmented and inadequate for addressing the scale and complexity of the risks they face. Institutional weaknesses, such as the breakdown of traditional livestock governance systems and the politicization of aid, are significant barriers to effective climate adaptation and mitigation. Furthermore, environmental degradation continues to be a major concern that, if left unaddressed, may worsen livestock vulnerability to climate change and environmental degradation.

Figure 3: Common Livestock Mitigation Strategies Practiced by Farmers

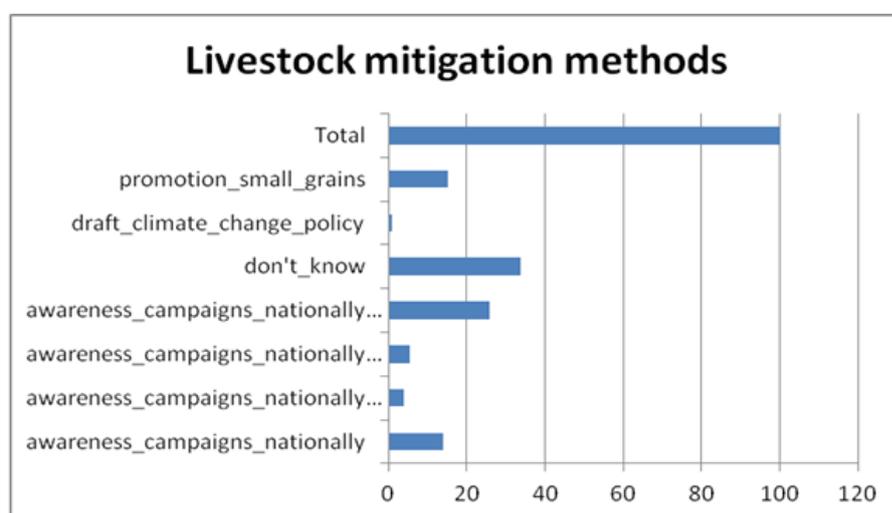


Figure 3 shows the mitigation practices adopted by livestock farmers to reduce climate-related risks. Approximately 40 percent of the respondents believed that awareness campaigns at national, district, ward and village levels were an excellent mitigation strategy and should be scaled up to ensure that locals fully understand and appreciate climate change issues and their impacts on livestock production practices. Four percent of the local farmers felt the climate change policy should be shared with smallholder farmers to enhance their understanding of strategies for mitigating climate change. While they were aware that such a policy was enacted, they expressed a need for more detailed information on the policy. Additionally, 20.5% of the respondents (Figure 3) believed that adopting small grains was an effective adaptation strategy, as it could complement their food sources.

However, 33.8% of the respondents were unaware of any mitigation strategies being implemented at various levels. Further investigations revealed that these were mostly semi-pastoralists who had little interaction with extension workers, as they suspected the workers of trying to take advantage of them or their livestock. Many of these semi-pastoralists owned large herds and resisted district extension workers' efforts to promote destocking initiatives. Some respondents, particularly those with tertiary education, cited long-term adaptation and mitigation strategies they were experimenting with, such as cross-breeding more adaptive livestock breeds, switching to smaller livestock like chickens, goats, rabbits and ducks, rotating grazing areas and cultivating fodder crops, although on a limited scale. Additionally, 53% of the respondents noted a significant increase in non-farm livelihoods within their households. The activities included cross-border trading, poaching, selling game meat and crafts, and mineral panning. Despite this, many farmers were reluctant to sell livestock to purchase supplementary feed due to their strong attachment to their cattle. As a result, overgrazing and environmental degradation became prevalent, as destocking was not a preferred option.

Mobilising National Mitigation Strategies

Figure 4: Key Institutions Spearheading National Livestock Mitigation Strategies



Figure 4 presents the main actors involved in promoting and coordinating livestock mitigation initiatives at national and local levels. The growing presence of NGOs in Beitbridge District highlights the increasing negative impacts of climate change and variability on local communities. Fifty-eight percent of the respondents identified NGOs as the key drivers of livestock mitigation programs in the district. Over the past five years, there has been a notable increase in the involvement of the Ministry of Environment, Climate and Wildlife, with 24% of the farmers reporting interactions with these ministry officials. Further investigation revealed that the Ministry, through its Climate Change Department, has been working in collaboration with the Civil Protection Department, Forestry Commission and various NGOs and agencies such as FAO and UNDP, and the WFP to either fund research through government departments or provide humanitarian assistance and support for climate mitigation initiatives.

The Forestry Commission's presence in the district also accounts for the establishment of protected forest areas. However, many communities expressed frustration over restrictions on

either inconvenient or too far from their villages. The awareness and training efforts take various forms, including pamphlets, road shows, farmer-field schools, and key messages shared during livestock auctions and field days. Farmers receive training on topics such as fodder crop production, supplementary feeding, cross-breeding, afforestation and reforestation, agroforestry, bylaws, vaccination, watering of livestock and natural resource management. Interestingly, indigenous knowledge is also promoted during field days, with traditional leaders encouraged to share their wisdom and experiences.

Impact of Current Mitigation Strategies

Figure 6: Perceived Success of Livestock Mitigation Initiatives.

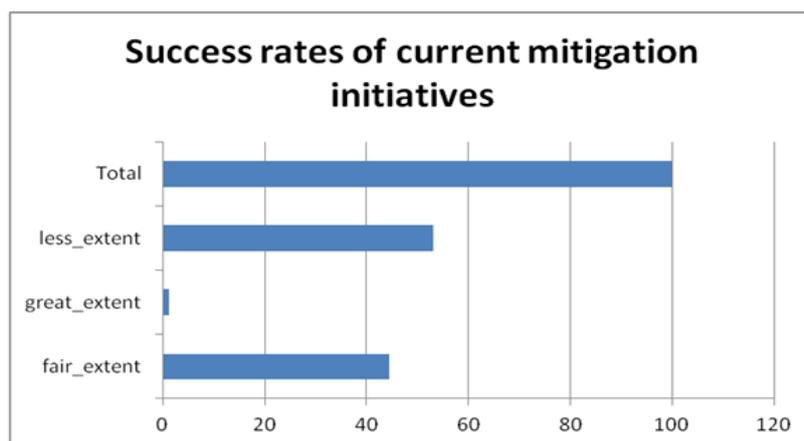


Figure 6 illustrates farmers' perceptions of the effectiveness and outcomes of implemented mitigation measures. Only 1.3% of livestock farmers felt that current mitigation initiatives have had a significant impact on farming practices. Approximately 44% indicated that these mitigation strategies were moderately effective. Farmers in both groups noted a reduction in livestock loss due to a shortage of pasture, and they observed that their livestock now fetch higher prizes in the marketplace. Some farmers have been able to purchase stock feed or hire bulls to promote cross-breeding and improve their herds. Additionally, some have been motivated to drill boreholes on their homesteads and implement pan-feeding to enhance the quality of their livestock. In other words, their attitudes toward livestock farming in the face of climate threats have improved, with limited adoption of climate-smart agricultural practices.

However, 53% of farmers did not see much value in the mitigation strategies implemented by various stakeholders in the district. Discussions with farmers revealed that there has been insufficient effort to inform and educate them about government plans and initiatives. As a result, the uptake of these strategies has been minimal. The top-down approaches used by government departments and non-state actors are problematic, as evidenced by the low participation of local farmers in mitigation programs. These top-down approaches violate both the Rural District Councils Act and the Traditional Leaders Act that promote the active involvement of local community structures in promoting development initiatives. Extension officers cited lack of transport and other resources as significant challenges that hinder efforts to scale up mitigation interventions. Some officers suggested that, for these initiatives to succeed, traditional leaders must first be engaged, as their influence could help promote the adoption of mitigation strategies at the community level.



Institutional Arrangements in Facilitating Mitigation Strategies

Efforts by extension officers to reach farmers are hindered by transport challenges and low salaries, making it difficult for them to effectively carry out their duties. Additionally, extension officers reported low motivation, citing a 'lack of cooperation from farmers' as a key issue. They expressed concerns about farmers' attitudes towards livestock, noting that many farmers do not view their livestock as a business. In particular, they observed that some farmers manage herds of over 200 animals, yet continue to rely on traditional, nomadic practices for livestock management.

Furthermore, 'farmer-field schools' are often attended primarily by cattle herders, as many farmers are either working in South Africa or perceive little value in attending local ward meetings or training sessions. Among male farmers, participation is low unless the sessions specifically focus on cattle. In contrast, training on goats and other small livestock tends to attract higher attendance from women and youth.

Farmers' Perspectives on Improving Livestock Mitigation Strategies

Farmers emphasized that education and training are crucial for encouraging practices such as destocking and use of crop residues, as well as promoting the cultivation of fodder crops through irrigation, the establishment of fodder banks, and investments in borehole drilling and other water harvesting techniques on either farmland or grazing land. They envisioned that these measures would spur downstream business opportunities, including the perception of livestock as a business venture with potential for value addition.

Farmers also called for the provision of livestock feed and fodder seed multiplication at the ward level, alongside the construction of strategic warehouses. They highlighted the need for improved grazing and pasture management through padlocking and relief grazing and the development of village feedlots. Additionally, they stressed the importance of further training on climate change and variability and their impacts on livestock production.

During focus group discussions, farmers recommended the formation of disaster risk reduction and climate change task forces or committees and farmer associations at the ward level. They also emphasized the importance of early climate warning systems and urged the integration and application of Indigenous knowledge and practices. These recommendations should be prioritized in the district's strategy document.

CLIMATE CHANGE LIVESTOCK ADAPTATION STRATEGIES

District/Ward/Village Adaptation Strategies

The following are some of the strategies that communities in Beitbridge District have adopted to help livestock adapt to climate change. Many farmers employed a combination of these strategies:

- Destocking (selling livestock)
- Shifting rotational grazing (paddock)
- Stover treatment and preservation



- Using fodder grasses/crops, supplementary feeding, feedlots, fodder banks at the local level, and cultivating fodder.
- Crossbreeding to develop more adaptive breeds
- Switching to small livestock (e.g. goats, sheep, chickens)
- Seasonal grazing in national parks (though illegal)
- Engaging in non-farm livelihoods
- Awareness campaigns and refresher courses

Non-farm livelihoods were adopted by 6.6% of the farmers, an emerging strategy where some farmers reinvest income from activities into livestock farming. Non-farm activities included selling airtime, cross-border trading, crafts, furniture making, welding services, hair salons and transport services (e.g., scotch carts).

Although grazing in national parks is prohibited, over 5% of farmers admitted to illegally driving their livestock into these areas during periods of pasture shortages. They acknowledged the risks of arrest, livestock diseases from interacting with wildlife, predation and theft by organized cartels.

Approximately 7.5% of farmers have shifted to small livestock such as goats, sheep, rabbits and chickens, which require less grazing land. These animals have higher turnover rates, providing farmers with quicker income, which they often invest in borehole drilling and purchasing supplementary feeds for cattle.

Farmers who recognized the impacts of climate change on livestock have diversified their livelihoods to maintain livestock production. About 15.2% of farmers have adopted fodder crops and grass cultivation, largely due to efforts of NGOs and government departments. Supplementary feeding has been adopted by 36.1% of farmers, who often travel up to 130 km to purchase feed in Beitbridge town. Some farmers smuggle stock feeds from South Africa, crossing the Limpopo River without using official border posts.

Mobilising Adaptation Interventions

Figure 7: Institutions Spearheading Climate Change Adaptation Mechanisms

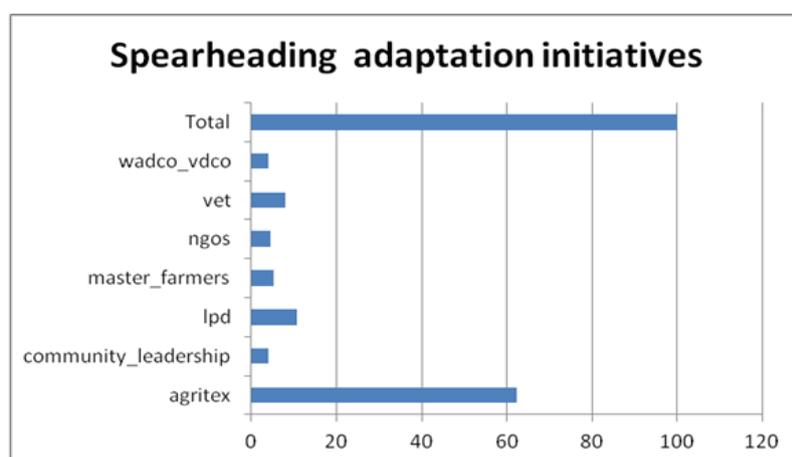




Figure 7 identifies stakeholders leading adaptation efforts in response to climate variability and change. AGRITEX leads the list of service providers facilitating livestock climate adaptation, with 62.3% of farmers identifying it as the primary support agency. One key advantage of AGRITEX is its personnel presence at the ward level, though their mobility remains limited. AGRITEX utilizes various platforms, such as cattle dipping days, workshops, field days and individual farmer visits, to deliver services.

The Livestock Development Department ranked second, with 10.6% of farmers reporting increased engagement from this agency. Veterinary Services followed at 7.9%, while Master Farmers were mentioned by 5.3% of the respondents. NGOs accounted for 4.6%, and community leadership was cited by 4% of participants.

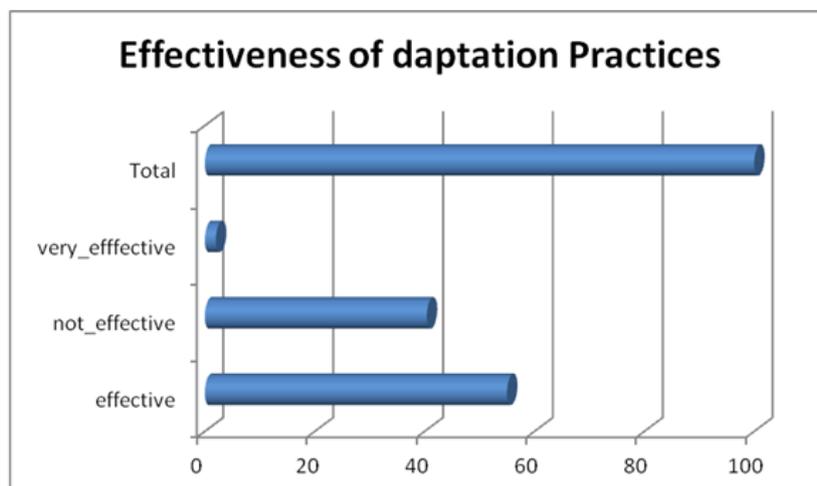
A combination of community leadership and master farmers, which was highlighted by 9.3% of the farmers, presents a promising sustainable opportunity to advance climate adaptation efforts. These local actors, being residents of the community, are likely to gain the trust and support of local farmers, enhancing the long-term success of the adaptation initiatives.

Effectiveness of Livestock Climate Adaptation Measures

Figure 8 illustrates farmers' perceptions of the effectiveness of the current livestock climate adaptation measures in Beitbridge District. Only 2% of respondents felt that the measures in place were 'very effective,' while 57.2% considered them 'effective.' However, a significant 40.8% of the farmers believed that the measures were 'ineffective,' indicating a considerable portion of the farming community that has yet to fully grasp the impact of climate change on their livestock practices. This group likely includes those who have been left out of awareness programs and have not been adequately reached by state and non-state actors.

The small 2% who rated the measures as 'very effective' are generally more educated, often with tertiary qualifications, and maintain frequent interactions with various stakeholders in the livestock industry. In contrast, the majority, 57.2%, have had exposure to teachings during field days, farmer field schools, and cattle dipping days. These experiences have helped them appreciate the importance of climate adaptation, and many are now willing to try out some of the measures being introduced in the district.

Figure 8: Effectiveness of adaptation measures. Source-Field Data





Cited evidence of effectiveness includes reduced livestock mortality, improved animal health and quality, and enhanced grazing conditions.

Livestock Adaptation Challenges

Farmers and extension workers in Beitbridge District reported a range of challenges. Many farmers lack knowledge about climate change and face recurrent droughts and flash floods while also lacking the resources to invest in climate adaptation initiatives. A common complaint was that the exploitation by middlemen in livestock marketing, driven by a lack of information, limited access to viable markets, and low producer prices. Additionally, relief grazing areas were plagued by livestock theft cartels and vector infestations.

Farmers were often unaware of relevant animal regulations and bylaws, and some perceived that extension workers were trying to take advantage of or rob them, particularly regarding livestock management. Environmental degradation—caused by fence destruction, deforestation, overgrazing, stream-bank cultivation, and the siltation of water bodies—was another significant issue farmers had to manage. While farmers were aware of community members involved in fence and livestock theft, they feared confronting them due to threats and these individuals' political connections.

Focus group discussions revealed that many local farmers tended to dismiss small livestock, which could more easily adapt to the local climate conditions. For men, livestock ownership primarily meant cattle, whereas women prided themselves on having large herds of goats and sheep. However, the high cost of livestock feed was beyond the reach of many farmers. Extension workers also noted a lack of cooperation and resistance to adopting viable adaptive strategies, which pointed to a lack of trust between farmers and extension workers. Some extension workers were even accused of stealing livestock and faced communication barriers as they could not speak the local language.

The lack of trust among different stakeholder groups undermined efforts to build capacity and resilience for local livestock farmers. Technology uptake was also low; for instance, very few farmers owned smartphones, limiting their ability to access information from other stakeholders. The ongoing liquidity crisis exacerbated farmers' frustrations, with many feeling abandoned by the government. Most farmers had not purchased livestock insurance, preventing them from spreading climate-related risks.

A significant barrier to adaptation was the belief that climate change did not exist. This perception weakened district-level intervention efforts, as some dismissed climate change as an 'act of God,' attributing it to ancestral anger that could be appeased to restore normalcy. The absence of information hubs further reinforced these misconceptions, hindering understanding of climate change and its impact on livestock production.

Improving Livestock Adaptation Strategies

Farmers, extension workers and other key stakeholders proposed a broad range of initiatives to improve livestock adaptation. One suggested approach was the formation of fodder producer groups, ensuring active participation of every household, which could significantly empower local farmers to produce their own stock feed. Establishing agro-dealer-based stock feed depots and promoting collective livestock marketing strategies, with strong local involvement, could advance the goals of producer-farmer associations.²¹ Producers, not buyers, should have



control over setting livestock prices. Additionally, establishing local meat processing plants would enable farmers to benefit from the added value in the livestock production chain. Transporting processed meat and related products to the market, rather than live animals, would be a more efficient strategy.

The government was encouraged to increase access to relief grazing for farmers and to facilitate training and education on climate change and livestock production. Promoting adaptive indigenous breeds and small livestock, along with water harvesting techniques, would help ensure adequate water availability for both farmers and their livestock. Well-travelled farmers noted that indigenous livestock breeds are well established across the border in South Africa and that acquiring knowledge and breeds from South African farmers, particularly across the Limpopo River, would be beneficial. Extension staff also expressed the need for capacity building, as they often held misconceptions about the impacts of climate change on livestock production. To address this, short courses covering climate change, disaster risk reduction, value chain addition, emerging livelihoods, assessment tools, climate early warning, monitoring and evaluation, and other relevant topics should be afforded to extension staff, community facilitators, and influential master farmers in the district and wards by universities and research institutions.

Training manuals in local languages will be essential for effective communication and capacity building among stakeholders. Farmers should also be informed about climate change policies, related policies, and related regulations, ensuring this information is disseminated in local languages so they can share it with other farmers in their communities.

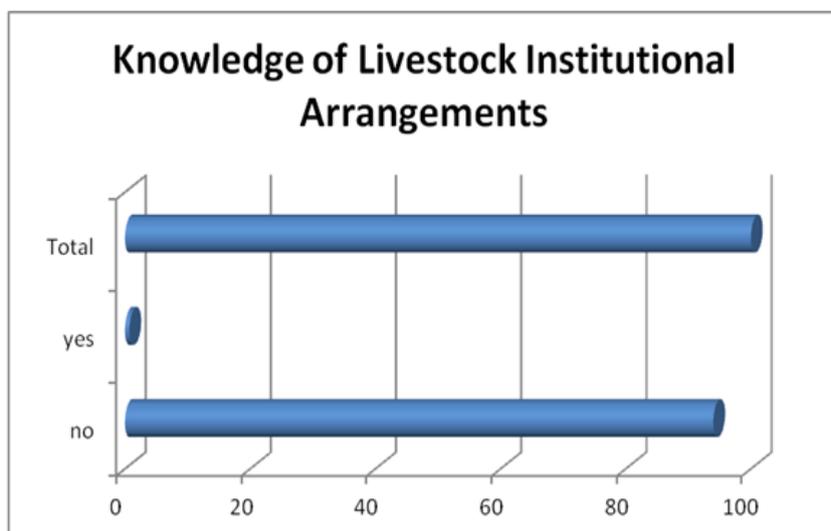
Establishing information hubs, staffed by trained locals, at the village or ward level, alongside village-level weather stations, is a key recommendation. Those managing these facilities should receive ongoing refresher training to stay informed about adapting to a changing climate. Disaster Risk Reduction (DRR) plans should be developed following comprehensive community vulnerability and capacity assessments, with active involvement from local farmers. The community-driven DRR plans should be regularly reviewed to incorporate emerging climate issues into village, ward and district plans.

Government departments also need capacity building on a wide range of issues related to climate change and livestock adaptation, ensuring they can continue to provide relevant advice to local farmers. Documenting indigenous climate early warning systems and related traditional knowledge is crucial, and this information should be available in the information hubs and integrated into school curricula. A conference should be held after this study, with participation from all stakeholder groups, to present and discuss the study's findings.

LIVESTOCK CLIMATE CHANGE, AND INSTITUTIONAL ARRANGEMENTS

Knowledge of Policies

Figure 9: Respondents' Knowledge of Climate Change and Livestock-Related Policies.



The figure presents the level of awareness among respondents regarding relevant national and sectorial policies. Farmers in Beitbridge District were generally unaware of local bylaws or national policies related to livestock production and climate change. While they could identify local by-laws and national regulations that affected their livestock- practices, such as those on animal movements, permits, clearances and. dipping requirements, around 94% of respondents had no specific knowledge of policies concerning climate change adaptation and mitigation in livestock production.

Only 6% of the farmers reported having heard about climate change offices or meteorological stations and having received messages from the Civil Protection Department on their phones (Figure 9). The farmers had participated in workshops or training sessions organized by either extension workers or NGOs. However, climate change-related policies were not readily available in extension offices, and farmers expressed frustration that any materials provided by NGOs or extension staff were often not in their local languages, making them difficult to understand.

Regarding overall awareness of climate change and livestock-related policies, 89.4% of the farmers were completely unaware of these policies, while 10.6% had only a vague understanding and were unable to specify any particular policy. The absence of local information hubs further exacerbated the challenges in accessing relevant policy information.

Distances from the nearest weather station

Most households in the study area were located far away from the nearest weather station. Only 5% of respondents had access to a weather station located 21 km away, while another station. 5% were as far as 77 km from the closest. Most of these stations were either outdated school facilities or situated on former commercial farms and were no longer operational. This situation



highlights the limited relevance of weather stations to the local farming community, which does not rely on or utilize these services.

Further investigation revealed that school children rarely shared weather information from these stations with their parents or the wider community. One farmer noted it is not common practice for schools to encourage students to communicate weather data to their families or neighbors. Weather stations are essential resources; deliberate efforts should be made to ensure they are accessible within a reasonable distance of local communities. Where funding permits, household-level digital weather stations, or at least village-based ones, could be considered to improve access to real-time weather information.

Traditional Institutional Arrangements

Modern pastoralism, incorporating improved livestock management systems, should be promoted through the government's acquisition and redistribution of more farmland to local communities. This was a suggestion made by a well-travelled local farmer who has interacted with both small-scale and commercial farmers in Beitbridge and South Africa.

Historically, farmers adhered to established schedules for livestock movement, sales, and other practices tied to the seasons (seasonal calendars). Communities also engaged in ritualistic activities, such as environmental cleansing and rain-making ceremonies, to encourage adequate rainfall. However, many older farmers lament that these practices have largely disappeared, contributing to the challenges posed by climate change. In the past, specific families would travel to sacred sites like Njelele Mountain in Matobo District to perform rain-making rituals on behalf of the community.²⁰ These ceremonies, when performed consistently, were believed to bring rain and mitigate climate threats.

Traditional laws regulated grazing, dropping, and the dissemination of information. Certain families were designated with specialized roles, such as environmental research or livestock disease treatment, while others focused on early warning systems. These structures, according to traditional leaders, were effective in fostering community resilience and should be revived and strengthened.

Livestock were also immunized against specific diseases, and practices were in place to help them acclimate when introduced to new environments. This collective community responsibility played a crucial role in safeguarding the community and ensuring preparedness against climate-related threats and disasters.

Institutional Arrangements in Information Dissemination

Most farmers, particularly those aged 65 and older, continue to rely heavily on traditional communication channels. Information is often shared during village meetings or at Chief's Court sessions. However, younger farmers have largely disconnected from these traditional sources. Extension services, specifically AGRITEX, were the most cited source of climate information, with over 20% of farmers reporting that they received information from this department. Only 2% of farmers mentioned receiving climate information through radio, while 7% relied on South African television for weather and climate updates. Other sources of information included village meetings, workshops, the Environmental Management Agency (EMA), NGOs, the livestock development department, SMS from friends and relatives, newspapers, and social media.



Type of Information Farmers Would Like to Receive from Identified Platforms

- The government should publicize well in advance, and regularly, programs aimed at addressing climate change and raising awareness, ensuring the use of local languages.
- Farmers understand the importance of understanding the outcomes of this study, as they believe its recommendations will help them effectively adapt to and mitigate climate change.
- Information on fodder seed production and early warning systems for climate-related risks.
- Weather and climate forecasts specific to Beitbridge to assist in planning. This information should be presented in simple terms and in local languages.
- Updates on policies related to small livestock, as well as adaptation, and mitigation strategies
- Best practices in traditional and cultural methods for climate mitigation and adaptation.

CONCLUSION

The baseline information on livestock climate mitigation, adaptation, and institutional arrangements from Beitbridge district reveals significant gaps and uncertainties. Many farmers hold misconceptions about climate change, often viewing it as an ‘act of God’ beyond their control. This detachment has contributed to the low adoption of climate-smart mitigation strategies and livestock adaptation practices. Additionally, minimal efforts have been made by communities and extension services to promote climate-livestock mitigation and adaptation.

A majority of farmers confuse policy frameworks with local cattle bylaws, indicating a lack of awareness about the specific policies governing climate and livestock management. The unavailability of these policies to farmers undermines the sustainability of government programs, whether planned or already in progress. The knowledge gaps among farmers in Beitbridge are substantial, and there is a pressing need for concerted efforts to empower both farmers and key stakeholders by addressing critical skills shortages, especially as climate change continues to impact livestock management.

RECOMMENDATIONS

Moving forward, farmers expressed concerns about livestock not being housed at night, which increased the risk of theft. The burning of rangeland after the winter season was a common practice, depriving livestock of essential grazing areas. Farmers urged the government to penalize those responsible for veldt fires. Additionally, deforestation, which accelerated environmental degradation, was highlighted as an issue that needed to be addressed urgently.

Farmers generally opposed policy reforms aimed at controlling livestock numbers, preferring instead the implementation of laws to protect animals in temporary grazing areas (relief grazing). Traditional leaders suggested that the government should institutionalize traditional practices, such as the use of shrines like Njelele and the observance of sacred days. They also emphasized the importance of teaching traditional early warning systems to younger



generations through community forums, and they considered these methods more reliable and informative than modern, scientific early warning systems.

From the perspectives of extension staff and other key stakeholders, the following policy considerations were recommended:

- ***Decentralization of Livestock Taxes:*** Local control over livestock tax revenue and other district-level taxes could promote investment in the district and help mitigate climate threats.
- ***Inclusive Consultations:*** Crafting relevant climate change policies should involve extensive consultations to ensure that local input regarding their relevance and applicability is reflected.
- ***Local Climate Change Office:*** Establishing a local office dedicated to climate change research training, awareness and networking would help address the district's specific challenges.
- ***Community Radio Stations:*** Setting up radio stations broadcasting in local languages (Venda, Shangani, Ndebele and Sotho) would facilitate effective information dissemination, particularly for livestock and other farmers.
- **Education Integration:** There should be a concerted effort to incorporate climate change and disaster risk reduction into the national school curriculum, from ECD to tertiary levels.
- ***Targeted Research and Farmer Information Hubs:*** Research efforts should inform policy actions and provide relevant information to farmers. Establishing information hubs in each ward, staffed by well-trained locals with support from extension workers, would offer a space for farmers to access critical information and skills through short, tailor-made courses on identified needs
- ***Livestock Restocking Program:*** Many farmers lost cattle, the district's primary livelihood asset, due to prolonged droughts. Livestock restocking programs are necessary, with institutions such as the National University of Science and Technology and extension services, facilitating training in "Livestock Emergency Guidelines and Standards" (LEGS)
- ***Regular Veldt Assessments:*** Periodic assessments of veldt conditions, vulnerability, and capacity would enhance adaptation and mitigation interventions, fostering more resilient livestock farmers. Applied research, monitoring, evaluation and learning should ensure that appropriate livestock numbers are maintained for the available grazing land.
- ***Revival of Cultural Practices:*** Cultural practices, norms, and values related to livestock production and value addition should be revived. There should be a focus on documenting these practices, along with regular monitoring and continuous evaluation to ensure their relevance and effectiveness.
- ***Ecosystem Restoration and Regenerative Agriculture:*** The Beitbridge Rural District Council, in collaboration with the National University of Science and Technology, should lead efforts to restore ecosystems and promote regenerative practices for



rangelands and farmlands. This will be essential to ensure the sustainable regeneration of pasture in the district.

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