Food and Agriculture Organization of the United Nations

LIVESTOCK CLIMATE ACTION IN **ZIMBABWE**

Enhancing nationally determined contributions for a sustainable future

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Abbreviations and acronyms

AEZ	agroecological zone
AFOLU	agriculture, forestry and other land use
BEST	Beef Enterprise Strengthening and Transformation
CCMD	Climate Change Management Department
CH_4	methane
CO_2eq	carbon dioxide equivalent
CSA	climate-smart agriculture
CSAIP	Climate Smart Agriculture Investment Plan
DLR	Department of Livestock Research
FAO	Food and Agriculture Organization of the United Nations
FMD	foot-and-mouth disease
GDP	gross domestic product
GHG	greenhouse gas
GoZ	Government of Zimbabwe
IPCC	Intergovernmental Panel on Climate Change
LEDS	Long-term Low Greenhouse Gas Emissions Development Strategy
LFSP	Livelihoods and Food Security Programme
LIPS-Zim	Livestock Production Systems in Zimbabwe
M&E	monitoring and evaluation
MAMID	Ministry of Agriculture, Mechanization and Irrigation Development
MECTHI	Ministry of Environment, Climate, Tourism and Hospitality Industry
MENRM	Ministry of Environment and Natural Resources Management
MEWC	Ministry of Environment, Water and Climate
MFED	Ministry of Finance and Economic Development
MLAFWRD	Ministry of Lands, Agriculture, Fisheries, Water and Rural Development
MLAWCRR	Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement
MLAWRR	Ministry of Lands, Agriculture, Water and Rural Resettlement
Mt	metric tonnes
MRV	monitoring, reporting and verification
MWRDM	Ministry of Water Resources Development and Management
N_2O	nitrous oxide
NAP	National Adaptation Plan
NCCRS	National Climate Change Response Strategy
NAPF	National Agriculture Policy Framework
NDS	National Development Strategy
NGOs	non-governmental organizations
NGP	National Gender Policy
NCP	National Climate Policy
NFP	National Forest Policy
OECD	Organisation for Economic Co-operation and Development
OPC	Office of the President and Cabinet
SAFE	Transforming Zimbabwe's Animal Health and Food Safety Systems for the Future
SDG	Sustainable Development Goal
ZAGP	Zimbabwe Agricultural Growth Programme
ZAIP	Zimbabwe Agricultural Investment Plan
ZCSAF	Zimbabwe Climate Smart Agriculture Framework
ZIMSTAT	Zimbabwe National Statistics Agency
ZRBF	Zimbabwe Resilience Building Fund

Executive summary

The Food and Agriculture Organization of the United Nations provided technical support to the Government of Zimbabwe on "Scaling up climate action to enhance Nationally Determined Contributions for climate and livestock", FMM/GLO/175/MUL. The project aimed to analyse the national policy environment for livestock climate action, engage in national stakeholder consultations to raise awareness and enhance knowledge on livestock mitigation and adaptation actions, and identify the needs and opportunities for upscaling. This study presents the findings of an extensive literature review, a policy analysis, a stakeholder consultation workshop, an expert survey and a validation workshop conducted in 2023 as part of this project's activities. It identified gaps, opportunities and recommendations for aligning livestock sector policies with climate change mitigation and adaptation goals.

In Zimbabwe, the increasing demand for animal source foods, sectoral growth and transformation in the past two decades has been driven by human population growth coupled with rising urbanization and incomes. Despite growing demand, livestock production remains below its potential, hampered by challenges such as feed and water scarcity, disease outbreaks and low productivity, exacerbated by climate change. The livestock sector also contributes significantly to Zimbabwe's greenhouse gas (GHG) emissions, mainly methane from enteric fermentation and manure management systems.

Zimbabwe has made strides in addressing climate change impacts in the livestock sector, prioritizing adaptation strategies in its nationally determined contributions (NDCs). There is a notable gap in terms of livestock-specific GHG mitigation strategies. Current policies show partial coherence in integrating livestock adaptation measures into broader agricultural and climate change frameworks, but robust GHG mitigation strategies are limited.

The development of Zimbabwe's Tier 2 GHG inventory for cattle emissions in 2023 marked a significant step forward. This inventory baseline allows for further assessment of mitigation potential and offers a foundation for future NDC updates. However, substantial data gaps remain, particularly concerning herd structure, production systems, feeding and manure management practices. Addressing these gaps is critical for improving GHG estimates and guiding effective mitigation interventions.

The stakeholder consultation revealed that many climate-smart strategies are already being implemented, including holistic grazing land management, forage production and livestock genetic improvement. These strategies, however, have not yet been formally assessed for their contributions to national adaptation and mitigation goals, limiting their inclusion in the country's NDCs. Enhanced research is needed to build an evidence base for integrating these strategies into future climate action.

The national stakeholders agreed on the following key recommendations:

1. **Enhance policy coherence:** Strengthen the alignment of livestock policies with national climate change mitigation and adaptation strategies. This includes mainstreaming climate-smart livestock practices into national development plans and ensuring coherence across sectors.
2. **Improve data collection:** Conduct a comprehensive livestock census and establish mechanisms for accurate collection of data on livestock production systems, herd structures and manure management systems to support ongoing updates to the Tier 2 GHG inventory.
3. **Expand stakeholder engagement:** Increase engagement with livestock sector stakeholders, including farmers, the private sector and local institutions, in climate action planning and policy implementation. Building their capacity in climate-smart practices will accelerate the adoption of effective mitigation measures.
4. **Support research and capacity building:** Strengthen research efforts to build an evidence base for climate-smart livestock strategies to inform policy decisions, and access climate finance. Training for livestock extension staff and stakeholders on data collection, monitoring and reporting will improve the implementation of climate action.

The study also provides strategies for disseminating findings, including translating this study into local languages and using various communication channels to reach all stakeholders. Additionally, the findings should be leveraged to secure climate finance to implement the proposed actions. By addressing data gaps, enhancing stakeholder engagement, and aligning livestock sector policies with climate objectives, Zimbabwe can enhance its ambitions in future NDCs and foster sustainable, climate-resilient livestock sector development.

1. Introduction

Zimbabwe's agriculture sector is crucial to socioeconomic development, providing employment to 65 percent of rural communities. The livestock sector contributed up to 34 percent to agricultural GDP in 2017 (Zimbabwe, Ministry of Lands, Agriculture, Water, Climate and Rural Resettlement [MLAWCRR], 2018a). The sector faces significant challenges, particularly climate change, the impacts of which livestock suffers from and contributes to through greenhouse gas (GHG) emissions. In 2017, Zimbabwe's net GHG emissions were estimated at 35.84 metric tonnes (Mt) of carbon dioxide equivalent (CO_2eq) (Zimbabwe, Ministry of Environment, Climate, Tourism and Hospitality Industry [MECTHI], 2022), with the agriculture, forestry and other land use (AFOLU) sector responsible for 54 percent of these emissions. Under a business-as-usual scenario, total GHG emissions in Zimbabwe are projected to increase by 110 percent to 75.4 Mt CO_2eq by 2030. Livestock-related activities are a key contributor, accounting for 42 percent of agricultural emissions, including 33 percent of CO_2 emissions from the conversion of forest land to grassland and 7 percent of methane (CH_4) emissions from enteric fermentation and manure management systems.

The Zimbabwean Government addresses climate change in the livestock sector through various policies and strategies on mitigation and adaptation measures. Zimbabwe revised its nationally determined contributions (NDCs) and submitted an updated version in 2021. The NDCs', livestock-related commitments are mostly adaptation measures for scaling up climate-smart agriculture solutions and strengthening the resilience of agricultural value chains and markets. These include climate-adapted livestock breeds, and improved livestock management, fodder production and feeding strategies. Zimbabwe also plans to implement NDC measures to increase resource use efficiency and minimize waste. Although the current NDCs exclude mitigation measures related to livestock due to insufficient data for estimating mitigation potential (Government of Zimbabwe [GoZ], 2021), the Government recognizes the need for stronger coherence between national policies and NDC commitments to drive the necessary systemic changes for low-emission and climate-resilient livestock production.

In this context, the Food and Agriculture Organization of the United Nations (FAO) has provided technical support to Zimbabwe's Department of Livestock Research (DLR) through the FVC subprogramme "Scaling up climate action to enhance Nationally Determined Contributions for climate and livestock", FMM/GLO/175/MUL. Under this project, the University of Zimbabwe analysed the national policy landscape related to climate action in the livestock sector, evaluating the alignment of policies and strategies with NDCs. FAO and the Ministry of Lands, Agriculture, Fisheries, Water and Rural Development (MLAFWRD) organized a national stakeholder consultation workshop on livestock climate action held in Mazowe, Zimbabwe from 14 to 16 November 2023 under this project. It provided a platform for practical discussions on assessing GHG emissions from the livestock sector and identifying mitigation measures aligned with the country's livestock development goals. The workshop also addressed the needs of livestock farmers in adapting to climate change and improving productivity through capacity development and policy dialogue.

Sustainable livestock systems can play a vital role in addressing climate change, poverty and food insecurity. By targeting climate change within the livestock sector, Zimbabwe can contribute to achieving the Paris Agreement's long-term goals while building more sustainable, resilient and climate-friendly agrifood systems. This study will guide Zimbabwe's livestock sector on implementing programmes and projects on climate change mitigation and adaptation. Future programming will focus on integrating livestock-related interventions in national climate action (forthcoming NDC update), capacity-building programmes, and enhanced GHG emissions reporting and assessments. This effort aims to culminate in developing comprehensive policy guidelines offering guidance on mitigation and adaptation interventions within the livestock sector.

2. Methodology

2.1. STAKEHOLDER CONSULTATION AND SURVEY

A national multistakeholder consultation workshop was convened to bring together key actors from livestock and environment domains from government departments and institutions, academia, livestock industry associations, finance institutions and development partners. The workshop aimed to raise awareness of the livestock sector's role in climate change and enhance understanding of climate action, particularly regarding institutional arrangements, policies and data availability. The workshop sought to identify synergies between livestock and climate change programmes, policies and development objectives through collaborative discussions and networking, and identify capacity development needs to address these challenges.

Participants engaged in breakout groups to explore the best practices and key interventions for reducing GHG emissions and enhancing adaptation in Zimbabwe's livestock sector. They also examined the main challenges from technical, institutional and policy perspectives, and discussed the necessary steps to overcome these obstacles and improve the implementation of climate-smart practices. A plenary session provided a platform to consolidate these discussions and identify opportunities to enhance national climate action, including integrating livestock-specific measures into the NDCs and long-term strategies.

Additionally, a stakeholder survey was conducted to gauge stakeholders' awareness of, knowledge about and engagement in national climate policies and actions. The survey (Annex 3) aimed to uncover gaps in knowledge and implementation of livestock climate action. The insights gained from this survey will inform future policy development, capacity-building initiatives and targeted interventions to enhance the effectiveness of climate action in the livestock sector. The survey results, integrated into the general stakeholder mapping, classify stakeholders based on their type, scale of operations and potential level of involvement in future climate-smart livestock actions. This analysis also captures the initial attitudes of stakeholders towards livestock climate action, indicating whether they are likely to embrace, oppose or remain neutral towards such initiatives, as well as their potential influence on these actions.

2.2. LITERATURE REVIEW AND POLICY ANALYSIS

An extensive review of national policy frameworks assessed the overall policy environment to support livestock climate action. The policy analysis examined the linkage between governmental policies, strategies and programmes from the livestock sector and the climate change domain. Further, qualitative and quantitative data were extracted from a wide range of literature, including the NDCs, the Third National Communication to the United Nations Framework Convention on Climate Change (UNFCCC), livestock master plans and value chain analysis reports published by the Ministry of Lands, Agriculture, Fisheries, Water and Rural Development (MLAFWRD) and other agencies. This information included historical GHG emission trends, the policy and investment landscape surrounding climate-smart livestock production, climate risks faced by the sector, barriers to adopting mitigation practices, and evidence-based climate-smart interventions suitable for Zimbabwean contexts. The insights from this comprehensive analysis inform strategies and recommendations for enabling transitions towards resilient and low-emission livestock production systems in the country.

The policy analysis used the analytical framework component of the Policy Coherence for Sustainable Development Framework (OECD, 2016). This tool was developed to support Sustainable Development Goal (SDG) target 17.14 on enhancing policy coherence for sustainable development. The framework provides guidance and a screening tool for, among other things, analysing coherence issues and how policy actions might support or hinder achievement of SDG goals and targets. The analytical framework component of the Policy Coherence for Sustainable Development Framework focuses on interlinkages among policies, i.e. how the planned policy outputs contribute to achieving the SDGs and the associated synergies and trade-offs. National socioeconomic development, agriculture and livestock, climate change, natural resources and environmental policy frameworks were analysed for this study. The reviewed policy frameworks include policies, strategies and action plans. A total of 22 policies were reviewed, i.e. five socioeconomic development policies, five agriculture and livestock policies, eight climate change policies, and four natural resources and environment policies. Each policy document was reviewed for the presence and detail of climate change adaptation and mitigation strategies, approaches and activities in the livestock sector. A scoring system and criteria were developed to describe the policy documents' support for livestock mitigation and adaptation measures. It considered strategies that were not explicitly listed as adaptation or mitigation strategies, but were a) listed in policies with overall adaptation and mitigation objectives and b) contributed to adaptation or mitigation.

TABLE 1
Scoring system and criteria to assess the policy's level of coherence with SDG 13 on climate action, and its level of support for specific climate change adaptation and mitigation measures in the livestock sector

Level of support	Description of the policy's coherence with SDG 13	Score
High	The policy **strongly aligns** with SDG 13 on climate action with regard to the livestock sector. It **devotes specific attention** to climate change adaptation and/or mitigation in the livestock sector. It includes specific activities, measures and approaches for livestock climate action.	3
Partial	The policy **supports** SDG 13 on climate action with regard to the livestock sector, but has relatively fewer details and specific activities, measures and approaches for livestock adaptation and/or mitigation.	2
Limited	The policy **supports** SDG 13 on climate action with regard to the livestock sector, but **lacks details** and specific activities, measures and approaches for livestock adaptation and/or mitigation.	1
None	There is **no evidence** that the policy supports SDG 13 on climate action with regard to livestock sector adaptation and/or mitigation.	0

Source: Authors' own elaboration.

2.3. VALIDATION PROCESS

Another national workshop was organized and held from 20 to 21 December 2023 in Harare, Zimbabwe, to validate the preliminary outcomes of the policy analysis and the recommendations of the first stakeholder consultation workshop. The validation workshop improved the quality of this study by ensuring that it reflected the discussed best practices, challenges and needs for mitigation and adaptation practices (section 6.2) and recommendations for enhancing livestock climate action (section 6.3) discussed during the first consultation workshop. The validation workshop also made recommendations on the further use of this study (section 7).

3. Overview and trends of the livestock sector in Zimbabwe

3.1. LIVESTOCK POPULATION

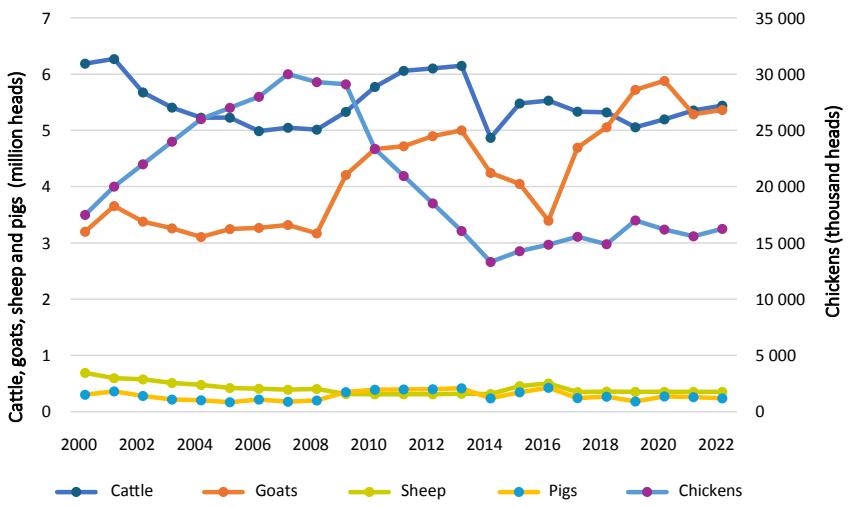
In Zimbabwe, cattle are the predominant livestock species, owned by 88 percent of smallholder farming households. Poultry ownership is also high among smallholders, with 89 percent of households keeping birds. Additionally, 73 percent of households own goats, 11 percent own sheep and less than 10 percent own pigs, while rabbit ownership is under 5 percent. Most smallholder settlements, 73.9 percent, are located in Natural Regions IV and V, which house 50–80 percent of the livestock due to poor crop yields. Goats and sheep are predominantly found in the drier, semi-arid regions, while cattle are more evenly distributed. Most small ruminants (70–75 percent) are concentrated in Natural Regions IV and V. The provinces of Matabeleland North, Matabeleland South, Midlands and Masvingo are particularly well suited to livestock production (Zimbabwe, MECTHI, 2022), with the livestock populations in 2022 estimated at 5.44 million cattle, 5.36 million goats, 0.35 million sheep, 0.24 million pigs and 16.26 million poultry (FAO, n.d.). Despite a large livestock herd and an increasing demand for livestock products, livestock production in Zimbabwe, particularly cattle, sheep, pigs and poultry, has remained below its potential (Figure 1). The cattle herd declined by 12 percent from 6.19 million in 2000 to 5.4 million in 2022, and it did not surpass its peak of 6.27 million in 2001. The national sheep flock dropped by 49 percent from 0.69 million in 2000. The pig herd has also stagnated in the past two decades, declining 21 percent from 0.3 million in the 2000s. Chicken populations declined by 7 percent from 17.5 million in 2000 despite the surge in small-scale farmers. However, for goats, the flock increased by 68 percent from 3.2 million in 2000 to 5 million in 2013.

3.2. LIVESTOCK PRODUCTION SYSTEMS AND FEED RESOURCES

Livestock production in Zimbabwe is characterized by a dual system comprising both commercial and smallholder systems. The smallholder system dominates in livestock numbers and mainly depends on communal grazing lands and crop residues utilizing indigenous breeds. At the same time, the commercial sector utilizes more intensive management practices with improved breeds and feed resources. Zimbabwe's arid and semi-arid regions occupy over 80 percent of the country's land area. These rangelands support extensive

FIGURE 1

Trends in cattle, goat, sheep, pig and chicken populations in Zimbabwe



Source: Adapted from **FAO. (Food and Agricultural Organization of the United Nations).** 2023. Crops and livestock products. [Accessed on 20 July 2024] https://www.fao.org/faostat/en/#data/QCL Licence: CC-BY-4.0

livestock production and wildlife, playing a vital economic and food security role for rural smallholder farmers who own most of the national cattle, goat, pig and chicken populations (Homann-Kee Tui *et al.*, 2022; FAO, 2017). In Zimbabwe, cattle are divided into two main categories: dairy and beef. The beef industry is more prevalent, with many smallholder farmers involved in beef cattle rearing due to its lower maintenance costs and adaptability to the country's diverse climatic conditions. The beef cattle industry is more extensive and dominated by indigenous breeds such as Mashona, Nkone and Tuli, which are well adapted to local conditions but have lower productivity than exotic breeds. Some improved and exotic breeds are kept in Zimbabwe: Angus, Boran, Brahman, Hereford, etc. Beef cattle are mainly raised in drier regions, such as the Mashonaland East provinces, Matabeleland North, Matabeleland South Masvingo and Midlands, where crop farming is less viable (Zimbabwe, Ministry of Lands, Agriculture, Water and Rural Resettlement, 2020a). Smallholder farmers primarily undertake beef production in communal areas, with some commercial ranches operating at a larger scale.

In contrast, the dairy sector is smaller but more intensive, largely relying on exotic breeds such as Holstein-Friesian for higher milk yields. Dairy farming is predominantly practiced in high-rainfall areas, mainly in peri-urban areas and commercial farms. Despite its smaller scale, the dairy sector has the potential for high returns and contributes significantly to the nation's nutrition and food security.

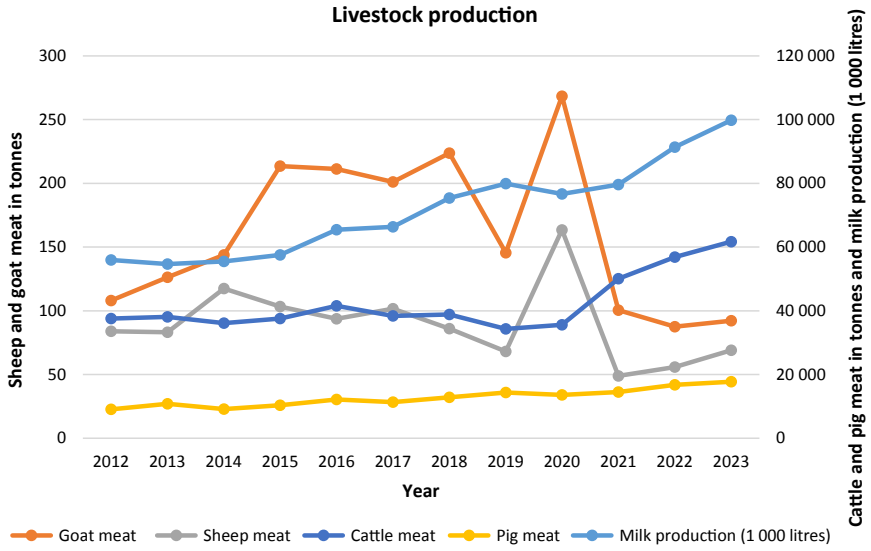
Livestock feed resources in Zimbabwe are diverse. The country primarily relies on natural pastures, crop residues and cultivated forages for livestock nutrition. Maize stover, a major crop residue, is widely used, especially during the dry season. However, its nutritional value is often low, necessitating supplementation. Cultivated forages include Rhodes grass, napier grass, and legumes such as lablab and velvet beans. Commercial feed production exists but is limited by high costs and input shortages.

Uncontrolled grazing and poor-quality crop residues due to low-quality vegetation and indigenous breeds lead to low-efficiency and high-emission livestock systems. Inadequate feed supply and quality (particularly during dry periods), limited access to quality breeds and resources, and climate change impacts such as drought and disease result in poor livestock performance, mainly low reproductive, growth and offtake rates. Diseases such as foot-and-mouth disease (FMD) and tick-borne January disease (theileriosis) result in high mortality, present an economic burden for vaccine importation and constrain trade potential. Zimbabwe's Livestock Recovery and Growth Plan sets targets to raise low productivity and address endemic health issues to increase climate resilience, reduce poverty, and enhance food and nutrition security through sustainable livestock intensification. Efforts are being made to promote drought-resistant forage varieties and improve pasture management practices. Additionally, there is growing interest in utilizing non-conventional feed resources such as acacia pods and cactus pear to enhance feed availability and quality.

3.3. LIVESTOCK PRODUCTS

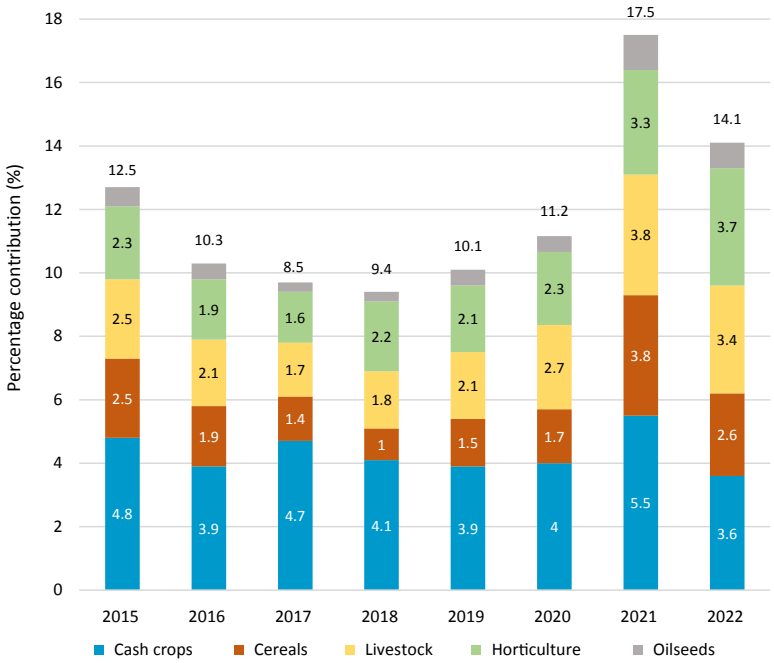
Figure 2 provides a comprehensive overview of meat and milk production trends between 2012 and 2023, reflecting

FIGURE 2
Trends in meat (goat, sheep and cattle) and dairy milk production in Zimbabwe



Source: **ZIMSTAT.** 2023. *Zimbabwe 2022 Population and Housing Census report.* Volume 1. Harare. https://www.zimstat.co.zw/wp-content/uploads/Demogr

FIGURE 3
Contribution of agricultural subsectors to national GDP



Source: Based on **Ministry of Finance, Economic Development and Investment Promotion (MFEDIP).** 2022. *Economic and fiscal report for the year 2022. 2022 Annual budget review*. Government of Zimbabwe. https://zimtreasury.co.zw/wp-content/uploads/2025/03/2022_Annual_Review_Final_30-June_2023.pdf

notable growth and fluctuations across livestock sectors. While cattle and milk production have experienced consistent and substantial growth, the goat and sheep meat sectors have seen more fluctuation. Pig meat continues to demonstrate a strong upward trend.

Cattle meat production increased significantly, rising from 37 529 tonnes in 2012 to 61 709 tonnes in 2023, with a marked acceleration in growth after 2021. Similarly, milk production saw continuous expansion, reaching 99 822 000 litres in 2023, up from 55 929 000 litres in 2012. This consistent upward trend highlights the growing importance of dairy and cattle meat in livestock production.

Goat meat production experienced considerable volatility during this period. Production peaked at 268 000 tonnes in 2020 but had declined sharply to 92 000 by 2023. Likewise, sheep meat production remained relatively stable for much of the period but saw a decline after 2020. From a high of 163 000 tonnes in 2020, production dropped to 69 000 tonnes by 2023, reflecting a downward trend. Furthermore, pig meat production steadily grew, nearly doubling from 9 066 tonnes in 2012 to 17 734 tonnes in 2023.

3.4. SOCIOECONOMIC DRIVERS OF LIVESTOCK PRODUCT DEMAND

The socioeconomic landscape in Zimbabwe has undergone significant changes in recent years, driving an increased demand for livestock products. The country's population currently stands at 15 million, having grown by 30 percent in the past two decades, along with a rapid urbanization trend. Accompanying this population growth, Zimbabwe has experienced substantial economic progress. The GDP per capita has risen to USD 957, representing a significant 163 percent increase. This rising income has directly impacted meat consumption, reaching 24.7 g per capita per day in 2020, showing a remarkable 155 percent increase (FAO, n.d.). These demographic and economic shifts have been key drivers of demand for animal-sourced foods, spurring sectoral growth. The livestock sector's contribution to the economy is substantial, providing employment to 65 percent of rural livelihoods and accounting for more than 20 percent of agricultural gross domestic product (GDP). Recent statistics indicate that livestock consistently contributed between 20 and 24 percent of agricultural GDP from 2015 to 2022 (Figure 3), potentially increasing this contribution to 36 percent at peak production Zimbabwe, (MFEDIP, 2022). As Zimbabwe progresses towards becoming an upper-middle-income economy by 2030, the demand for livestock products is expected to continue growing. This trend will likely catalyse various forms of intensification in smallholder production systems, which must adapt to meet the rising demand. The observed human population growth, urbanization and rising incomes will continue to drive the transformation of the livestock sector,

underscoring its importance in Zimbabwe's socioeconomic development.

3.5. DEVELOPMENT PROGRAMMES IN THE SECTOR

The cattle sector is the largest livestock subsector, and has received significant policy and institutional support compared to other subsectors. This support has fostered the development of technical knowledge to improve feed, health and breeding technologies. Market operations, infrastructure and auctions have been developed in the commercial and communal sectors. Recent major support programmes for beef and dairy cattle include the Beef Enterprise Strengthening and Transformation (BEST) project and the Transforming Zimbabwe's Dairy Value Chain for the Future project under the Zimbabwe Agricultural Growth Programme (ZAGP). Other notable programmes include the Zimbabwe Resilience Building Fund (ZRBF), the Livelihoods and Food Security Programme (LFSP) and the Livestock Production Systems in Zimbabwe (LIPS-Zim).

In contrast, the goat sector remains largely informal, with limited technical support and significant productivity gaps. Individual private-sector initiatives are making efforts to commercialize goat production, but the markets and value chains are still mostly informal, with poor infrastructure and pricing mechanisms. Key support programmes for the goat sector include the ZAGP's Value Chain Alliance for Livestock Upgrading and Empowerment project, the ZRBF and the LSFP.

The pig sector, primarily organized by the private sector, benefits from production and technical knowledge support provided by the Pig Industry Board (PIB) and extensive breeder networks. The market and value chain consists of large-scale industrial systems alongside numerous smallholders. The ZAGP's Value Chain Alliance for Livestock Upgrading and Empowerment project is a notable recent support programme for this sector.

Similarly, the poultry sector is driven by both private-sector and informal initiatives, with support for production and technical know-how coming from both the public and private sectors. The value chain is predominantly large-scale industrial, involving many smallholder farmers. Major support programmes in the poultry sector include the ZAGP's Inclusive Poultry Value Chain project, the ZRBF and the LFSP.

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4. Livestock and climate change in Zimbabwe

4.1. CURRENT AND FUTURE CLIMATE CHANGE IN ZIMBABWE

Over three quarters of Zimbabwe's total area is semi-arid, and the country experiences a single, unimodal rainfall season with relatively high temperatures ranging from 15 °C to 25 °C between October and March. Data from 1982 to 2017 shows that the mean annual rainfall is 640 mm. Rainfall varies significantly across the country, increasing from 400 mm in the southwest to 1500 mm in the eastern highlands. Rainfall variability is also high, with most country areas exhibiting a variation coefficient exceeding 30 percent. High average temperatures contribute to significant potential evaporation. The region is also prone to extreme weather events such as droughts and floods.

4.1.1. Current and historical climate change

A climate shift occurred in Zimbabwe in 1982, marking a transition to a new rainfall and temperature regime. While total annual rainfall has only declined slightly (from 670 mm to 640 mm), the intraseasonal characteristics have changed more significantly (Manatsa *et al.*, 2020). The greater northern parts of Zimbabwe are now experiencing a delayed start of the rainy season by up to 18 days, while some southern parts are seeing an earlier start (Intergovernmental Panel on Climate Change [IPCC], 2022a). The rainy season has shortened by 30 days across most of the country due to an earlier end, reducing the number of rainy days and affecting water availability. There are also more dry spells during the season, with their length increasing by up to 20 days in most areas (Figure 4a).

There has been noticeable warming since the climate shift, with maximum temperatures increasing by an average of 1 °C. Monthly maximum temperatures in February, May and June have increased significantly over the past 70 years in central, eastern and southern Zimbabwe (Figure 4b). Spatially, minimum temperatures in the winter months are getting colder in some northern districts, such as Hurungwe, Guruve, Lupane and Mbire. Consistent with this general warming trend, Zimbabwe has seen increases in extremely hot days and nights, and hottest days, along with decreases in extreme cold days and nights in recent decades (Manatsa *et al.*, 2020).

Since the 1982 climate shift, a larger proportion of agro-ecological zones in Zimbabwe has shifted towards drier, less productive conditions. More land area is now classified as Natural Region V, while the more agriculture-friendly Regions III and IV have declined. About 12 percent of former Region IV land is now Region Va, 9 percent of Region V land is now Region Vb, and 8.5 percent of former Region IIIa land has shifted to Regions IV (7.3 percent) and Va (1.2 percent) (Figure 5).

4.1.2. Projected climate change

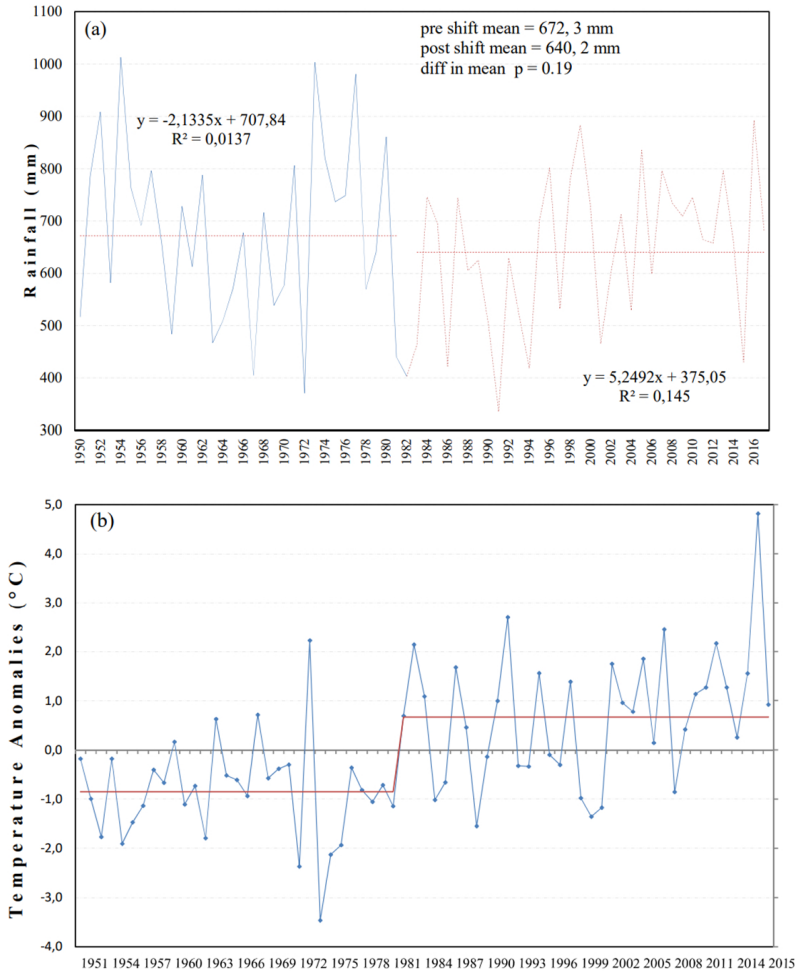
IPCC has identified Southern Africa, including Zimbabwe, as a future climate change hotspot due to its reliance on highly climate-sensitive rainfed agriculture and the high vulnerability of its impoverished population (IPCC, 2018). Average temperatures in Zimbabwe are projected to rise more than the global average, with associated declines in rainfall, increased temperature, more volatile weather patterns and less reliable growing seasons. Under a high-emissions scenario, mean annual temperatures in Zimbabwe are expected to increase by 1–1.5 °C by 2040 compared to the 1986–2005 baseline (Figure 6) (GoZ, 2021).

At 1.5 °C of global warming, extreme hot days during the warm season could see temperature increases of up to 3 °C, accompanied by more frequent hot nights and longer, more intense heatwaves (IPCC, 2018). Rainfall is projected to decline, particularly over Zimbabwe's Limpopo basin. At 2 °C of global warming, robust decreases in rainfall of about 10 percent are anticipated, leading to shorter rainy seasons (Figure 7). Rainfall events are expected to become more intense, potentially exacerbating flood risks (Figure 9).

Spatially, the southern and eastern regions of Zimbabwe are expected to experience the most significant rainfall declines between 2020 and 2060, increasing the likelihood of drought (Figure 8). The National Adaptation Plan (NAP) indicates a high probability of more severe droughts due to decreasing rainfall, while flood risks will persist in low-lying areas and near dams (IPCC, 2018).

FIGURE 4

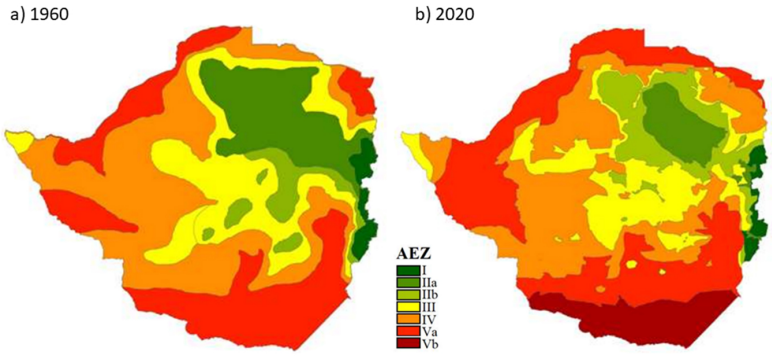
(a) Temporal pattern of total annual rainfall and (b) temperature anomalies: 1950–2017



Source: Based on **Manatsa, D., Mushore, T.D., Gwitira, I., Wuta, M., Chemura, A., Shekede, M.D., Mugandani R., Sakala, L.C., Ali, L. H., Masukwedza, G.I., Mupuro, J.M., and Muzira., N.M.** 2020. Revision Of Zimbabwe's Agro-Ecological Zones. ISBN (In Press). https://cris.library.msu.ac.zw/bitstream/11408/5282/1/AEZ2020%20Final%20Report%20withcitation%20statement_inPress.pdf

FIGURE 5

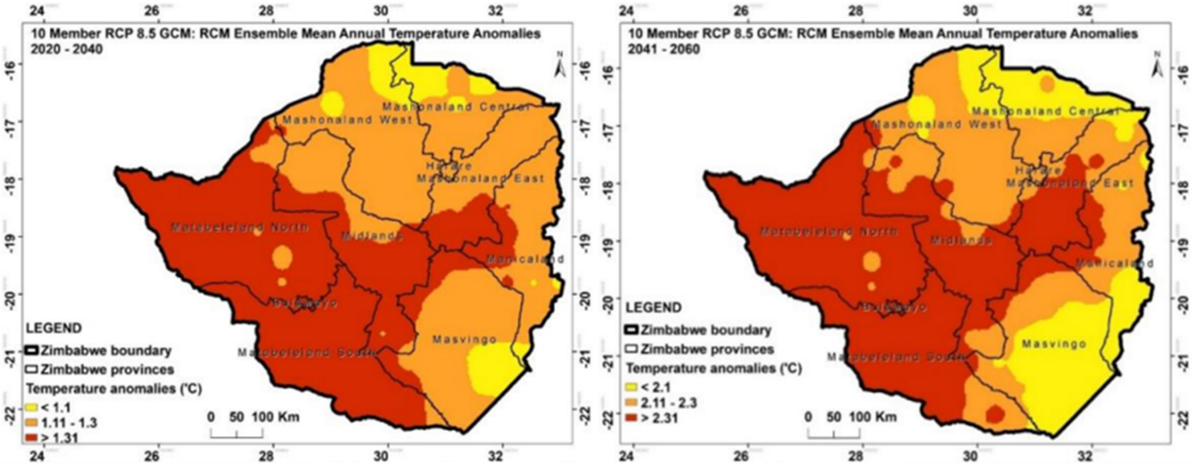
Changes in the spatial extent of Zimbabwe's historical (a) and current (b) agroecological regions



Source: Based on **Manatsa, D., Mushore, T.D., Gwitira, I., Wuta, M., Chemura, A., Shekede, M.D., Mugandani R., Sakala, L.C., Ali, L. H., Masukwedza, G.I., Mupuro, J.M., and Muzira., N.M.** 2020. Revision Of Zimbabwe's Agro-Ecological Zones. ISBN (In Press). https://cris.library.msu.ac.zw/bitstream/11408/5282/1/AEZ2020%20Final%20Report%20withcitation%20statement_inPress.pdf

FIGURE 6

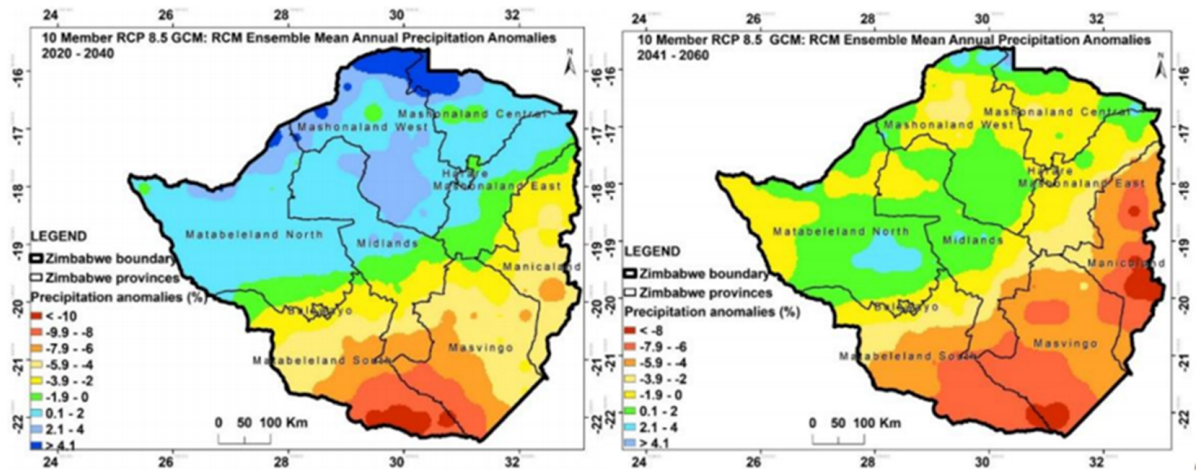
Spatial distribution of Zimbabwe's average temperature increases for the periods of 2020–2040 (left) and 2040–2060 (right) under Representative Concentration Pathway 8.5



Source: **GoZ.** 2021. Zimbabwe Revised Nationally DeterminedContribution. Government of Zimbabwe, 2021. https://unfccc.int/sites/default/files/NDC/2022-06/Zimbabwe%20Revised%20Nationally%20Determined%20Contribution%202021%20Final.pdf

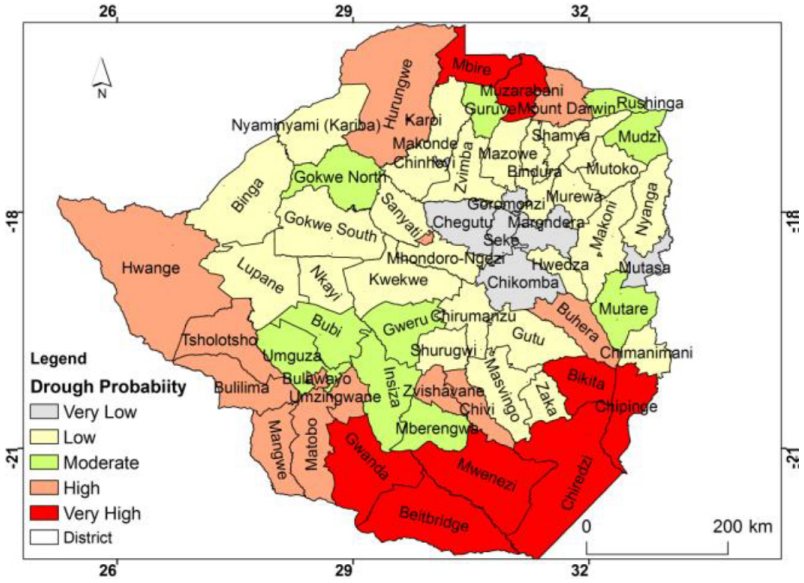
FIGURE 7

Spatial distribution of Zimbabwe's mean annual rainfall for the periods of 2020–2040 (left) and 2040–2060 (right) under Representative Concentration Pathway 8.5



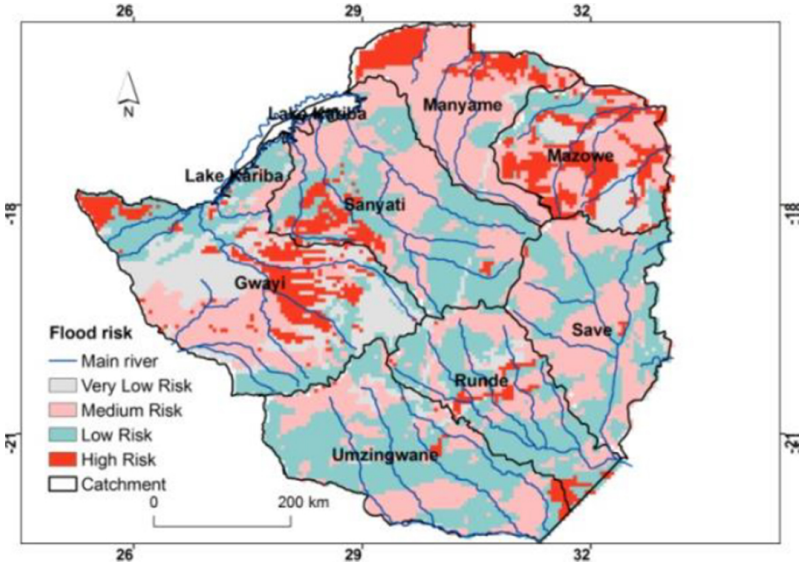
Source: **GoZ.** 2021. Zimbabwe Revised Nationally DeterminedContribution. Government of Zimbabwe, 2021. https://unfccc.int/sites/default/files/NDC/2022-06/Zimbabwe%20Revised%20Nationally%20Determined%20Contribution%202021%20Final.pdf

FIGURE 8
Drought probability map of Zimbabwe



Source: **Zimbabwe, MECTHI.** 2023a. *Zimbabwe's Climate Change National Adaptation Plan*. Harare. http://www.forestry.co.zw/wp-content/uploads/2023/10/Zimbabwes-Climate-Change-National-Adaptation-Plan.pdf

FIGURE 9
Flood risk map of Zimbabwe



Source: **Zimbabwe, MECTHI.** 2023a. *Zimbabwe's Climate Change National Adaptation Plan*. Harare. http://www.forestry.co.zw/wp-content/uploads/2023/10/Zimbabwes-Climate-Change-National-Adaptation-Plan.pdf

4.2. IMPACT OF CLIMATE CHANGE ON RANGELAND AND LIVESTOCK

The impacts of climate change on rangelands, livestock productivity, food security, income and livelihoods in Zimbabwe are interconnected and particularly severe for smallholder farmers. These farmers, who hold the majority of the livestock herd in communal areas, are highly vulnerable due to their reliance on rainfed agriculture and limited alternative income sources.

Rainfall patterns, including the timing, duration and number of rain days during the summer, strongly influence primary production in Zimbabwe's semi-arid rangelands. Recent assessments using the Normalized Difference Vegetation Index indicate a decline in vegetation density and productivity across the country, largely attributed to changing climatic conditions (Manatsa *et al.*, 2020). This decline is especially evident in the decreasing productivity peaks in natural vegetation and worsening vegetation loss during dry spells, with less robust regrowth after droughts.

Rising temperatures are projected to negatively impact livestock, driven by changes in feed quality, the spread of diseases, and water resource availability (Table 2). Climate change is expected to alter rangeland composition and reduce herbage quality, diminishing feed availability. Grass development and associated rangeland feed intake have declined significantly – by 10 percent during rainy periods and 50 percent during dry spells. Additionally, on-farm maize residue yields, crucial for fodder, have decreased by approximately 15 percent, exacerbating existing fodder shortages in semi-arid regions. As a result, livestock sales have dropped by about 50 percent under climate change scenarios, with mortality rates rising by 8 percent for small herds and 14 percent for large herds (Antle *et al.*, 2018).

Water stress poses another critical challenge, especially in Zimbabwe's driest areas. As temperatures increase from 1.5 °C to 2 °C in Southern Africa (IPCC, 2018), water availability is expected to decline due to higher evaporation rates, reduced river discharge and diminished groundwater recharge, particularly in southern catchments such as the Mzingwane and Runde rivers (Barthel *et al.*, 2009; Davis and Hirji, 2014). This heightened aridity will reduce moisture availability for crops, affecting the suitability of maize- and sorghum-growing areas, and causing significant yield losses, especially for C3 crops (IPCC, 2018). By 2050, the area suitable for dairy farming is projected to decrease by 25 percent compared to current conditions (Mhlanga *et al.*, 2018).

Extreme temperatures will likely further impact livestock through increased heat stress, reduced feed intake and nutrient utilization, decreased animal production and reproduction, and higher incidences of livestock diseases and mortality. Simulation models estimate a significant reduction in economic returns from livestock, with beef cattle income expected to decrease by 11 to 13 percent by 2040, and sheep and chicken incomes declining by 13 to 15 percent and 17 to 21 percent, respectively (Milne, Mekonnen and Benitez Ponce 2019). Though less vulnerable, goats could still see income reductions of 7 to 9 percent. Heatwaves are also projected to reduce milk production in dairy cattle by 10 to 14 percent, leading to a 35 to 39 percent decrease in annual milk production for small herds and a 30 to 35 percent reduction for large herds (Descheemaeker *et al.*, 2016).

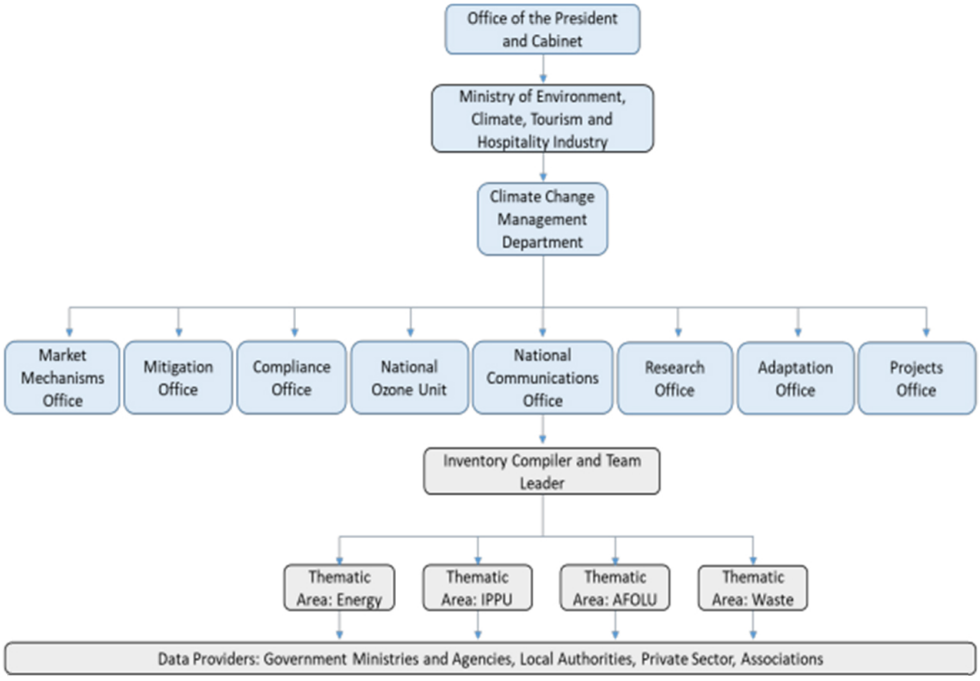
Livestock diseases are anticipated to spread further as climate change alters the distribution of hosts and pathogens.

TABLE 2
Climate hazards and impacts on Zimbabwe's livestock sector

Climate hazards	Impacts
Increase in: • day and night temperature; • heat waves and heat stress on crops; • shorter and warmer winter season; • dry spells; • frequency and severity of droughts; • incidence of intense rainfall; • cyclones, floods and strong winds; and • shifts in the onset, cessation and length of the rainfall season.	**Increase in:** • damage to water infrastructure for livestock and agricultural infrastructure due to extreme weather events; • area coverage of drier agroecological zones; • livestock deaths from heat and water stress, and crop losses; • national food and nutrition insecurity; • waterlogging, runoff and soil erosion; and • outbreaks of FMD.
Decrease in: • seasonal rainfall amount; and • rainfall season length.	**Decrease in:** • surface and ground water availability for irrigation and livestock watering; • productivity of soils; • livestock feed availability and quality; • crop and livestock productivity; • animal and plant health; and • food security and income for rural livelihoods.

Source: Adapted from *Source:* **Zimbabwe, MECTHI.** 2023a. *Zimbabwe's Climate Change National Adaptation Plan*. Harare. http://www.forestry.co.zw/wp-content/uploads/2023/10/Zimbabwes-Climate-Change-National-Adaptation-Plan.pdf

FIGURE 10
Climate change governance and institutional arrangements in Zimbabwe



Source: **Zimbabwe. MECTHI.** 2022. *Fourth National Communication to the United Nations Framework Convention on Climate Change*. Harare. https://unfccc.int/sites/default/files/resource/Zimbabwe%204th%20National%20Communication%20to%20the%20UNFCCC.pdf

For example, the range of several ixodid tick species, which cause economically significant diseases such as cowdriosis, anaplasmosis, bovine babesiosis and theileriosis, is expanding (Nyangiwe, Yawa and Muchenje, 2018). In Zimbabwe, tick hotspots are species-specific, with particular tick species occupying distinct localities. Climate-sensitive livestock diseases will likely have the greatest impact on poor and vulnerable smallholder livestock keepers, who are also burdened by soil salinity, outbreaks of FMD, knowledge gaps, and limited access to resources and markets. Although FMD outbreaks are not directly associated with rainfall, seasonal patterns influence their occurrence across regions (Guerrini *et al.*, 2016). In contrast, the range of the trypanosomosis-bearing tsetse fly may shrink in southern Africa due to projected temperature increases and land-use changes (Bett *et al.*, 2017).

4.3. CLIMATE CHANGE GOVERNANCE AND INSTITUTIONAL ARRANGEMENTS

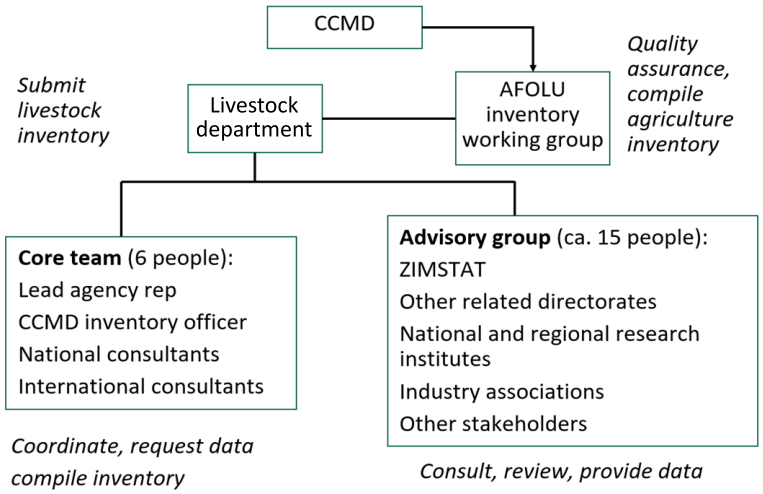
4.3.1. Institutional arrangements for climate change activities

The institutional arrangements for climate change governance in Zimbabwe are presented in the National Climate Policy (NCP) (Zimbabwe, MEWC, 2017) and updated in the Fourth National Communication to the United Nations Framework Convention on Climate Change (Zimbabwe, MECTHI, 2022) (Figure 10). At the national level, climate change activities are overseen by the High-Level Committee within the Office of the President and Cabinet (OPC). This committee, led by the OPC, includes permanent secretaries from all government ministries. The primary responsibility for coordinating and implementing national climate change programmes falls to the Climate Change Management Department (CCMD), which operates under the Ministry of Environment, Climate, Tourism and Hospitality Industry. The CCMD is tasked with creating national communications and biennial transparency reports. A multisectoral National Climate Change Committee has been established to support these efforts and provide sector-specific and cross-sector guidance, coordination and advice. This structure ensures a comprehensive approach to addressing climate change issues across various governmental sectors. The current institutional arrangements for climate change governance promote a bottom-up approach led by local authorities and communities in decision-making, monitoring, and evaluating adaptation and mitigation measures.

4.3.2. Institutional arrangements for livestock sector climate action

Livestock industry players have been involved in national projects involving livestock climate action, such as consultations during NDC preparation and livestock GHG inventory reporting. In the draft NDC implementation plan, the MLAFWRD

FIGURE 11
Institutional arrangements for livestock Tier 2 inventory compilation and reporting



Source: Adapted from **Unique.** 2022. Institutional arrangements for compilation of tier 2 greenhouse gas inventory for Zimbabwe's cattle sector. Paper presented at the *Inception Workshop on the Development of a Tier 2 Greenhouse Gas Inventory for Cattle Emissions in Zimbabwe*. 12 September 2022, Holiday Inn, Harare.

is assigned as the lead implementing entity for all agriculture and livestock adaptation measures, and as a supporting partner or financier for other NDC actions involving agriculture. National GHG inventory compilation and reporting is the mandate of the CCMD. However, livestock GHG inventory compilation requires technical knowledge of livestock production and networks with key stakeholders in the livestock sector to ensure the use of accurate and reliable livestock activity data and expert advice. Furthermore, the assessment of GHG mitigation options in the livestock sector needs to consider technical feasibility and align with livestock sector policies and programmes. Therefore, the Government's DLR under MLAFWRD assumed the lead role in coordinating the compilation of the livestock GHG inventory under the mandate of the CCMD. Figure 11 shows the institutional arrangement for inventory compilation set up by the DLR in consultation with the CCMD.

The DLR designated a staff member to be the GHG inventory officer, responsible for technical tasks under the direction of the department's leadership. Then, the DLR established an inventory core team (up to six people) consisting of the DLR Directorate, the GHG inventory officer, and national and international experts. A GHG inventory officer from CCMD was also included in the core team to ensure that the livestock sector inventory aligned with the national inventory activities. The inventory core team's role is to collect and analyse data, and compile the inventory. The DLR facilitates this through official data requests, convening consultations, and interministerial communication. The DLR also officially appointed stakeholders and experts to an advisory group. The advisory group members provide data, help make contact with other stakeholders in the sector, are consulted on inventory design issues, and review the draft inventory.

4.4. MONITORING, REPORTING AND VERIFICATION OF LIVESTOCK CLIMATE ACTION

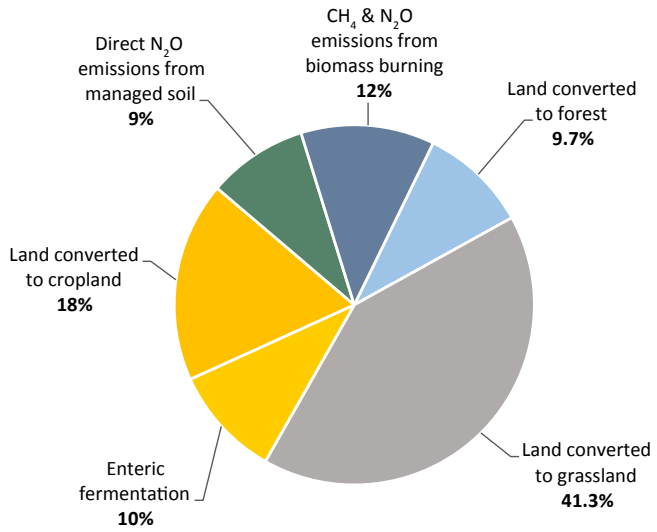
Under the UNFCCC's enhanced transparency framework, developing country Parties are required to submit national communications and biennial transparency reports (formerly biennial update reports) every four and two years, respectively, as a means of monitoring, verifying and reporting on the countries' progress towards addressing climate change. Both documents include a GHG inventory report. Zimbabwe has compiled and reported its first, second, third and fourth national communications in 1998, 2016, 2012 and 2022, respectively. The country also reported its first biennial update report in 2020, which included livestock emissions. In all these national communications, livestock emissions were derived using the Tier 1 approach, and enteric fermentation significantly contributed to national GHG emissions. In the transition to improve the national GHG inventory, the country has now compiled a Tier 2 GHG inventory for cattle emissions (see section 4.5 of this study) under the coordination of the DLR. For livestock adaptation measures listed in the NDCs, there are no operational monitoring and evaluation (M&E) systems in the country. The Government still needs to develop and apply its M&E system for adaptation measures to track progress in achieving the target. The M&E systems should involve the main funders, development partners and key institutions involved in implementation.

4.5. NATIONAL GHG INVENTORY AND LIVESTOCK EMISSIONS

Considering the emissions and removals (sources and sinks of GHG) in Zimbabwe, the AFOLU sector was the largest contributor to national net GHG emissions in the year 2017 with 61 percent, as outlined in the Fourth National Communication (Zimbabwe, MECTHI, 2022) and Biennial Update Report (Zimbabwe, MECTHI, 2020a). In 2017, GHG emissions from the AFOLU sector were estimated at 42 029 gigagrams (Gg) of CO_2eq, while removals were estimated at 14 911 Gg CO_2eq, giving a net positive flux of 27 118 Gg CO_2eq (Zimbabwe, MECTHI, 2020a). Livestock is a key contributor to the agricultural GHG emissions in the country, as livestock-related activities contribute 51 percent of sectoral emissions through CO_2 emissions resulting from conversion of forest land to grassland (41 percent) and CH_4 emissions from livestock (10 percent) (Figure 12). Beef and multipurpose cattle produce 68 percent of total livestock enteric CH_4 emissions, followed by dairy cattle (17 percent) and goats (11 percent), while emissions from pigs are insignificant (Figure 13).

FIGURE 12

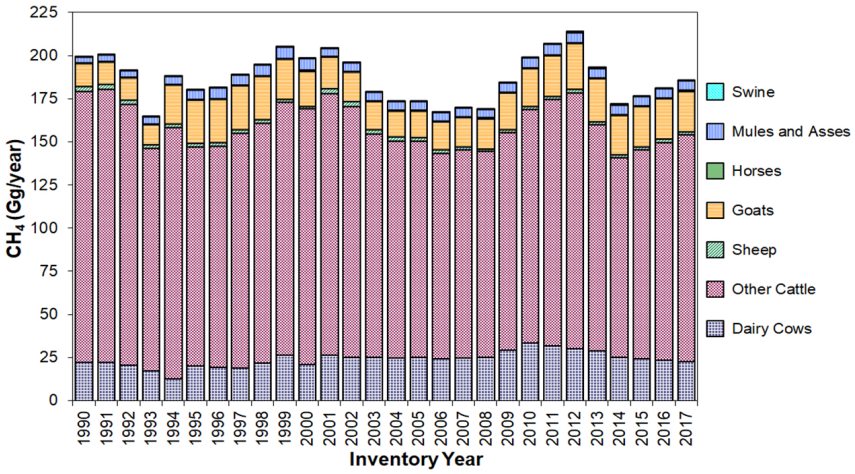
GHG emissions from the AFOLU sector in 2017



Source: Adapted from **Zimbabwe. MECTHI.** 2022. *Fourth National Communication to the United Nations Framework Convention on Climate Change*. Harare. https://unfccc.int/sites/default/files/resource/Zimbabwe%204th%20National%20Communication%20to%20the%20UNFCCC.pdf

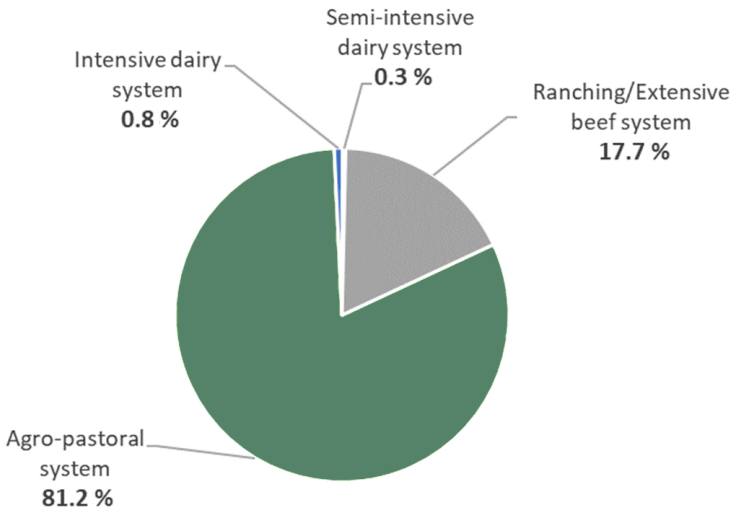
FIGURE 13

Enteric CH_4 emission profile of livestock in Zimbabwe, 1990–2017



Source: **Zimbabwe, MECTHI (Ministry of Environment, Climate, Tourism and Hospitality Industry).** 2020a. *Zimbabwe's First Biennial Update Report to the United Nations Framework Convention on Climate Change*. Harare. https://unfccc.int/sites/default/files/resource/Zimbabwe%20Biennial%20 Update%20Report%201.pdf

FIGURE 14
Contribution of different production systems to livestock emissions



Source: **Svinurai W., Gumindoga B., Tambo G., Wassie S., Wilkes A.** (forthcoming). *Inventory of GHG emissions from cattle in Zimbabwe (1990–2021) calculated using the IPCC Tier2 method*. Harare, Zimbabwe, MLAFWRD and Ministry of Environment, Climate and Wildlife.

It is estimated that in 1990, total enteric CH_4 emissions from cattle amounted to 507.38 Gg CH_4 and decreased to 416.69 Gg CH_4 in 2021. This decrease is attributed to the decline in cattle population, and changes in cattle management and performance. Indigenous livestock breeds in the extensive agropastoral system contribute between 5 percent and 75 percent of total cattle emissions (Svinurai *et al.*, 2018), which can be attributed to poor-quality feeds. From its first to its fourth national communications, Zimbabwe has been compiling its livestock GHG emissions using the Tier 1 approach. Given the considerable contribution of livestock cattle to national GHG emissions, Zimbabwe recently developed a Tier 2 inventory for cattle emissions to account for the effects of different agroecological zones, cattle production systems, animal categories and performance. The Tier 2 inventory development was coordinated by DLR and received financial support from the New Zealand Government's Ministry for Primary Industries, and technical support from the New Zealand Agricultural Greenhouse Gas Research Centre, Unique land use GmbH and national consultants.

4.5.1. GHG emissions across livestock production systems

Based on the country's recently developed Tier 2 inventory, the agropastoral production system contributes 81 percent of cattle emissions, followed by beef ranching (18 percent). In comparison, dairy cattle emissions account for only 1 percent of total cattle emissions due to small population size (Figure 14). Overall enteric emissions ranged between 7 984 Gg CO_2eq in 1990 and 8 323 Gg CO_2eq in 2021 (Svinurai *et al.*, 2023). The global warming potential values used are 1 for CO_2, 25 for CH_4 and 296 for nitrous oxide (N_2O). In terms of emission sources in the extensive cattle production system, enteric fermentation CH_4 (90 percent) is the largest contributor, followed by manure management N_2O emissions (4 percent) (Table 3). The cattle emission profile is dominated by enteric fermentation due to poor-quality crop residues, and manure management emissions due to inadequate manure management strategies. Overall, Tier 2 emissions have doubled from those reported in the previous national inventory reports (use of Tier 1) and will likely increase livestock's contribution to national emissions. The large share of livestock emissions, particularly from extensive cattle systems in Zimbabwe, highlights the need to assess the mitigation potential of adequate animal husbandry practices to inform livestock climate policy decision-making.

4.5.2. Data gaps and quality issues of Zimbabwe's Tier 2 cattle GHG inventory

Zimbabwe's Tier 2 cattle GHG inventory faces significant data limitations that hinder accuracy and reduce confidence in the results. These challenges primarily stem from the lack of representative survey estimates on herd structure and the proportions of different cattle production systems. Additionally, there are substantial data gaps regarding the productive and reproductive performance of Zimbabwe's cattle herds, as current estimates rely mainly on small-scale studies that do not adequately reflect productivity levels across the country's diverse cattle production systems. Furthermore, there is a notable absence of information on manure management

TABLE 3
Greenhouse gas emissions from extensive beef production system in Zimbabwe in 2021

Emissions	Gg CO_2eq	Percent contribution
Enteric fermentation CH_4	8 543	89.7
Manure management CH_4	2 105	2.2
Manure management direct N_2O	395	4.1
Manure management indirect N_2O	49	0.5
Manure deposit on pastures direct N_2O	116	1.2
Manure deposit on pastures indirect N_2O	214	2.2
Total	**9 528**	**100**

Source: **Svinurai W., Gumindoga B., Tambo G., Wassie S., Wilkes A.** (forthcoming). *Inventory of GHG emissions from cattle in Zimbabwe (1990–2021) calculated using the IPCC Tier2 method*. Harare, Zimbabwe, MLAFWRD and Ministry of Environment, Climate and Wildlife.

practices in Zimbabwe. Expert judgment has been employed for certain parameters to compensate for these data gaps.

4.5.3. Improvements planned for the livestock GHG inventory

While Zimbabwe has made significant progress by developing its first Tier 2 GHG inventory for the livestock sector, considerable efforts are still needed to build robust, accurate and sustainable domestic capacity for ongoing inventory development, which is crucial for informing effective mitigation policies. The next steps include building capacity within the DLR to enable continuous updates and future reporting on the inventory. Livestock improvement needs must be integrated into the plans and budgets of relevant government agencies. Additionally, prioritizing data collection, particularly for agropastoral and extensive beef systems, will help reduce uncertainties in these production systems. Increasing awareness among stakeholders in the livestock sector about the importance of a Tier 2 GHG inventory is also critical. This inventory sets the stage for conducting mitigation assessments of livestock-related climate action and will inform the next NDC update, scheduled for 2025.

4.6. ADAPTATION PRACTICES AND MITIGATION OPTIONS IN ZIMBABWE

4.6.1. Improved grazing land management

Improved management of grazing lands offers significant benefits for both climate change mitigation and adaptation. Practices such as rotational grazing and maintaining optimal stocking rates can substantially increase carbon sequestration in soils and vegetation, effectively reducing atmospheric CO_2 levels. These enhanced grazing methods also improve soil health, water retention and biodiversity, making grazing lands more resilient to climate change impacts such as droughts and floods. Additionally, better managed grazing lands can enhance forage quality and quantity, boost livestock productivity, and reduce CH_4 emissions per unit of product.

Silvopastoral systems, which integrate trees into grazing lands, further amplify these benefits by increasing carbon storage, providing shade for animals and diversifying farmer income sources. Reducing biomass burning in grasslands and forest lands, which currently contributes 9 percent of the AFOLU sector's GHG emissions, is another crucial strategy. In Zimbabwe, veld (name of grassland/rangeland across southern Africa) fires have destroyed approximately 1 million hectares annually over the past decade, with a record 1.75 million hectares burned in 2022. Recognizing this, Zimbabwe's revised NDC prioritizes reducing the area burned by 500 000 hectares between 2020 and 2025, including agricultural production landscapes. This initiative is expected to result in a 28–40 percent reduction in national GHG emissions by 2030 compared to baseline levels.

The combined benefits of improved grazing land management, including enhanced plant species diversity, improved forage quality, and strengthened ecosystem stability, make it a powerful approach for addressing climate change mitigation and adaptation in the livestock sector.

4.6.2. Improved feed and water management

Climate-smart practices in Zimbabwe's livestock sector can be advanced by optimizing feed conversion efficiency. Due to its high digestibility, incorporating concentrate feed into ruminant diets is one approach to reducing enteric CH_4 emission intensities. However, the effectiveness of this strategy depends on several factors, including the rate of feed concentrate inclusion, the production purpose, and the composition of the basal diet. Despite its potential, the high cost of concentrate feed poses a challenge for communal farmers in extensive livestock systems where grain availability is limited.

In response to these challenges, drought- and heat-tolerant leguminous forages, such as velvet bean, have shown great promise, particularly in Zimbabwe's drier regions. These forages have been integral to livestock development projects such as the ZRBF, the LFSP, the ZAGP and the LIPS-Zim.

According to the mitigation assessment in the CSAIP, feeding velvet bean fodder during the dry season has led to a 63 percent reduction in total feed intake and a 56 percent decrease in CH_4 emissions from cows, while also improving cattle profitability with a benefit-to-cost ratio of about 1.5 to 1.9 (Milne, Mekonnen and Benitez Ponce, 2019).

Beyond feed strategies, the Government also promotes various water management techniques in the livestock sector. Common in-field rainwater harvesting technologies in Zimbabwe include planting pits, contour ridges with infiltration pits, tied ridges, fanya juu terraces and zai pits (Manyanga, Soropa and Lawrence, 2022). Additionally, efforts are being made to rehabilitate water points and establish boreholes in drought-prone rural communities to ensure reliable water sources for livestock.

4.6.3. Livestock breeding and management

The Government and development agencies are implementing many strategies listed in NDS1 to promote indigenous livestock breeds, as prioritized in the country's NDCs. Key initiatives include establishing a national bull centre and semen processing laboratory to preserve animal genetic materials and develop stress-resilient animal breeds. Efforts to expand artificial insemination are also underway, particularly targeting recently resettled (A1) smallholder farmers. Additionally, strengthening animal transfer programmes for dairy and small ruminant producers could further boost productivity. Other impactful measures include establishing breeding and genetic enhancement hubs and model farms, disseminating improved livestock breeds, directing output toward export sectors, and assisting farmers through ongoing training of livestock extension personnel. Improving livestock production efficiency at the herd and farm levels offers the greatest potential for reducing GHG emissions in Zimbabwe's extensive livestock systems. By 2025, the Government aims to enhance various livestock management parameters to support these goals (Table 4).

4.6.4. Animal health improvement

Improving animal health and welfare of cattle through effective management and control of diseases directly improves livestock productivity and reduces GHG emissions. Such improvements have been promoted in the ZAGP and LIPS-Zim projects by strengthening veterinary services, facilitating investment in disease surveillance and prevention measures, and promoting the establishment of veterinary infrastructure. Preventative animal health measures such as improved biosecurity, vaccination and dosing, coupled with good nutrition, help livestock perform optimally and reduce emission intensities. The extensive beef producers have benefited from the ZAGP Transforming Zimbabwe's Animal Health and Food Safety Systems for the Future (SAFE) project by transforming animal health and food safety systems through public-private partnerships at rehabilitated Anchor Animal Health Management Centres and launching the Animal Pests and Diseases Surveillance Plan aimed at reducing livestock losses from diseases such as theileriosis and other tick-borne diseases.

4.6.5. Livestock early warning system

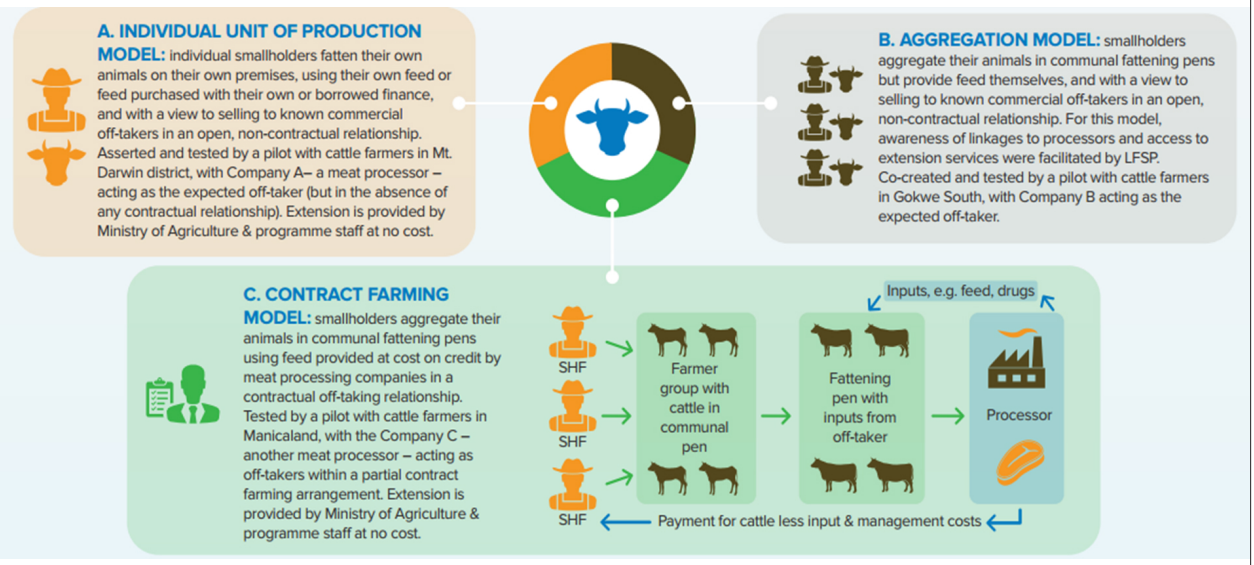
Despite facing significant challenges from recurrent droughts and floods, Zimbabwe has no fully integrated and operational early warning system at the national level. The country relies on support from the Famine Early Warning Systems Network, a prominent provider of climate risk early warnings and food insecurity analyses. This network issues monthly reports and maps that outline existing and predicted food insecurity, and timely alerts for potential crises. Additionally, at the regional level, the African Flood and Drought Monitor is a platform for monitoring and forecasting upcoming flood and drought threats. To enhance flood

TABLE 4
Current and targeted livestock performance targets in Zimbabwe

Performance indicator	Current Level (2020)	Target 2025
Cattle calving rate (%)	45	55
Cattle offtake (%)	6	10
Calf mortality (%)	17	5
Cattle mortality	9	5
Beef average carcass weight (kg)	160	200
Kidding rate (%)	98	110
Lambing rate (%)	65	100
Milk production per cow/day - large scale (L)	15	20
Milk production per cow/day - smallholder (L)	8	15
Average litter size per sow	8	12

Source: **Zimbabwe, MLAWRR.** 2020a. *Second round crop an livestock assessment report, 2019/2020 season*. Harare. https://fscluster.org/zimbabwe/document/second-roundcrop-and-livestock

FIGURE 15
Models used to integrate smallholder cattle systems into the beef value chain in Zimbabwe



Source: **LFSP (Livelihoods and Food Security Programme).** 2018. *INFOGRAPHIC: Cattle Pen Farming. Zimbabwe*. [Cited 4 March 2025]. https://lfspzwcom.wordpress.com/2018/07/17/infographic-cattle-pen-fattening/

and drought risk management within the country, a more comprehensive national version of the regional monitor is in progress – the Zimbabwe Flood and Drought Monitor system. This initiative aims to fortify risk management efforts and assist national agencies and stakeholders in effectively addressing these hazards.

4.6.6. Livestock markets and value chain development

The Government, development organizations and the private sector have been working to develop Zimbabwe's livestock market infrastructure and value chains. This involves implementing financial services-led livestock development initiative models, which gradually phase out government-guaranteed programmes towards wholly private sector-driven financing models (Figure 15). The Government leads in harmonizing the collection of levies to reduce the cost of compliance in livestock production, and establish comprehensive Livestock Information Management and Traceability Systems for crop and livestock assessment, disease control and market access. In the LFSP, the programme and market players co-created ten models across four areas, i.e. input market development, contract farming, output market development and mechanization, seeking to nurture inclusive agribusiness models that offer potential financial and social returns to market actors and smallholder households.

4.6.7. On- and off-farm diversification

Diversification of on- and off-farm enterprises into activities such as apiculture, aquaculture, rabbitry and livestock intensification presents a viable strategy to climate-proof livestock production in vulnerable smallholder systems. For Zimbabwe, it involves commercializing fish, rabbits, bees and small stock (goats, sheep and pigs) by creating livestock business centres based on the hub-and-spoke model. The success of such diversification and intensification thrives on strengthening agricultural research and linking it with extension services, agriculture education and farmers.

In Zimbabwe's semi-arid crop-livestock systems, particularly in the Nkayi district, proactive diversification and intensification strategies have proven beneficial. As demonstrated by Homann-Kee Tui *et al.* (2022), the integration of traditional grains and legumes with livestock, supported by inclusive and functional value chains and improved access to information, results in higher returns per unit of land. This integrated approach not only enhances farm resilience but also boosts productivity and profitability in the face of climate risks.

5. Livestock and climate change policy analysis

5.1. NATIONAL POLICY ENVIRONMENT FOR LIVESTOCK CLIMATE ACTION

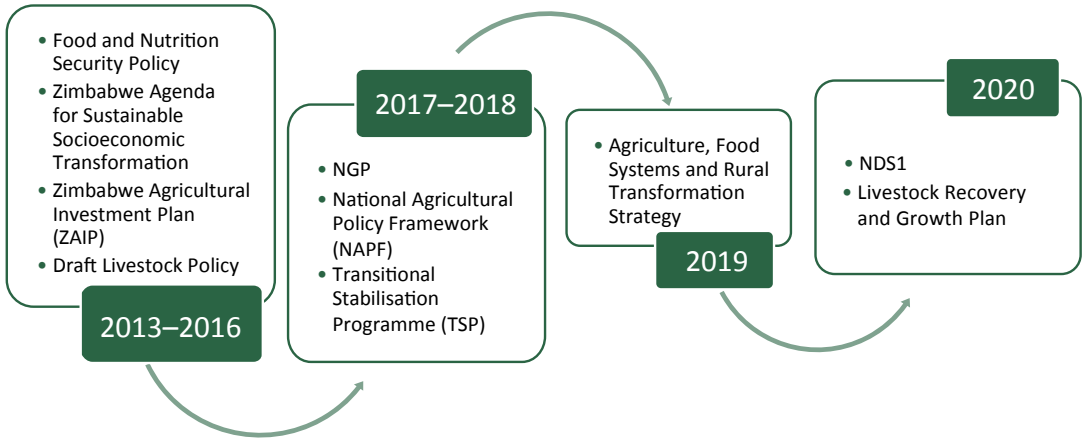
In 2018, the Zimbabwean Government launched Vision 2030, which aims to transform Zimbabwe into an "Upper Middle-Income Economy by 2030". Agriculture, a key sector for economic prosperity and national security, is central to realizing this vision. To set the stage for Vision 2030, the Government introduced the Transitional Stabilisation Programme (TSP) (2018–2020) (GoZ, 2018), followed by the five-year National Development Strategy 1 (NDS1) (2021–2025) (Zimbabwe, MFED, 2020), with NDS2 (2026–2030) forthcoming. Complementing these initiatives, several agriculture-specific policies were established, including the National Agriculture Policy Framework (NAPF) (2018) (Zimbabwe, MLAWCRR, 2018a), the Agriculture, Food Systems and Rural Transformation Strategy (2019) (Zimbabwe, MLAWRR, 2019), and the Livestock Recovery and Growth Plan (2020) (Figure 16). Together, these policies drive the implementation of the agriculture and livestock sector development targets outlined in the NDS1. Furthermore, climate change policies such as the Climate Smart Agriculture Framework (2018) (Zimbabwe, MLAWCRR, 2018b) and the Climate Smart Agriculture Investment Plan (2019) (Milne, Mekonnen and Benitez Ponce, 2019) also aim to enhance climate resilience in the agricultural sector (Figure 17).

5.1.1. National socioeconomic development policies

The national socioeconomic development policies established in Zimbabwe before the Paris Agreement have provided a foundation for formulating national policies with livestock adaptation and mitigation measures. The Food and Nutrition Security Policy (2013) (OPC, 2013) set the foundation for disaster preparedness, urging investments to enhance the resilience of vulnerable households to climate change. The policy was the basis for formulating the food security and nutrition cluster in the Zimbabwe Agenda for Sustainable Socio-Economic Transformation (Zim Asset) (2013–2018) (GoZ, 2013). It offered a clear plan to achieve sustainable development and recognized the need to tackle climate change through sustainable socioeconomic transformation in agriculture, among other sectors. It aimed to strengthen climate and disaster management policy in its food security and nutrition cluster.

Over the same period, Zimbabwe adopted a revised National Gender Policy (NGP) in 2017 that includes a specific

FIGURE 16
Development of national socioeconomic, agriculture and livestock policy frameworks in Zimbabwe



Source: Authors' own elaboration.

thematic area on gender and climate change, and promotes the mainstreaming of gender in environmental and climate change policies, strategies and action plans, and their implementation. The NGP recognizes that women are particularly vulnerable to the impacts of climate change and need to be prioritized in response programmes.

Between 2018 and 2020, the Government of Zimbabwe developed the TSP to guide the economic reform process and set the tone of Vision 2030 through macroeconomic and fiscal projections and resource requirements for the targeted sectors. The TSP aimed to integrate measures into national policies, strategies and planning to strengthen resilience to and adaptive capacity for climate-related hazards and natural disasters. The programme aimed for a full recovery of the national livestock herd. It contained measures with climate adaptation benefits, including the provision of breeding stock, a phased FMD Control Fence Programme and vaccination campaign, and improvement of farmer access to markets for livestock as a quick-win intervention.

The NDS1 was formulated in 2020 to guide the implementation of activities stipulated in the TSP. This is the country's first five-year medium-term plan for the livestock sector, which aims to realize the country's Vision 2030 while simultaneously addressing the global aspirations of the SDGs and Agenda 2063. The policy emphasizes the strategies for promoting resilience and sustainable agriculture production systems but does not explicitly state strategies for adaptation and mitigation. The NDS1 prioritizes animal production and health by strengthening farmer knowledge and skills to improve livestock production and health, to enhance productivity and ensure resilience and sustainability.

5.1.2. Agriculture and livestock policies

The Zimbabwe Agricultural Investment Plan (ZAIP) (2013) (Zimbabwe, MAMID, 2013) was the Government's most comprehensive investment plan for implementing the former Agricultural Policy Framework and contributing to attaining Zim Asset. Its overall goal was to facilitate a sustainable increase in the production, productivity and competitiveness of Zimbabwe's agriculture by building the capacity of farmers and institutions, and improving the quality and quantity of public, private and development partner investment and policy alignment. These strategies support climate adaptation and mitigation measures in the livestock sector. A draft Livestock Policy was formulated in 2015 with specific attention to the development of a livestock climate change adaptation and mitigation strategy in line with the NCP, promoting beneficiation from carbon credits, exploitation of multispecies ruminant systems, and livestock early warning and emergency preparedness systems.

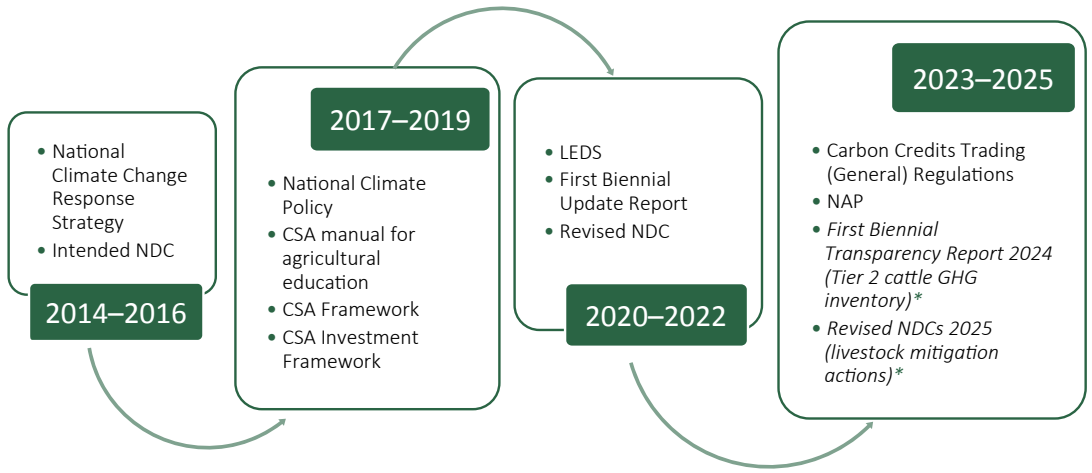
The NAFP (2018–2030) (MLAWRR, 2018a) serves as a strategic guide for agricultural development in Zimbabwe. It aims to create a vibrant, efficient, inclusive and sustainable sector catering to the needs of diverse stakeholders, including smallholder farmers, rural communities, and agribusinesses. It acknowledges agriculture's significant contribution to GHG emissions and its vulnerability to climate change impacts on crop yields, water availability and livestock productivity. The policy recognizes agriculture's critical role in addressing climate change, and the importance of climate resilience and mitigation. It emphasizes the need to promote climate-smart agriculture (CSA) practices to reduce GHG emissions, enhance the adaptive capacity of agricultural communities, and promote crop and livestock insurance.

The Agriculture, Food Systems and Rural Transformation Strategy (2020–2024) (Zimbabwe, MLAWRR, 2019), updated to the Agriculture, Food Systems and Rural Transformation Strategy in 2023, sets the sector's vision of a prosperous, inclusive, diverse, sustainable and competitive agricultural sector by 2030. The Livestock Recovery and Growth Plan (unpublished), which is now replacing the draft Livestock Policy, aligns well with the objectives and strategies of the NDS1, the NAPF, the Agriculture, Food Systems and Rural Transformation Strategy and the draft Livestock Policy. The plan seeks to promote the establishment of private sector-driven and community-owned livestock business centres for feed lots, cattle sales and input distribution at the district level to champion all livestock value chain development issues. Although not explicitly mentioned, its strategies contribute significantly to adaptation and mitigation outcomes. These include climate-proofing livestock production focused on the commercialization of fish, rabbits, bees and small stock production through small stock breeding and genetic improvement centres, and champion farmers; intensive dipping programmes; local production of vaccines for tick-borne diseases; strengthening enforcement of animal movement regulations; animal identification and traceability; establishment of breeding centres with active participation by the private sectors; and proper selection of breeds with the best desirable characteristics available locally.

5.1.3. Climate change policies

Zimbabwe's National Climate Change Response Strategy (NCCRS) (Zimbabwe, MEWC, 2015) set the country's foundation for climate change policy. The NCCRS outlines Zimbabwe's approach to ensuring sustainable development and a climate-proofed economy, recognizing the vulnerable nature of Zimbabwe's natural resources and society. This strategy is anchored on seven pillars, including adaptation and risk management, mitigation and low carbon strategies. The NCCRS includes livestock sector-specific actions to make the nation climate-resilient with a low-carbon econ-

FIGURE 17
Development of the climate change policy framework in Zimbabwe



*Not yet developed.
Source: Authors' own elaboration.

omy. It recognizes that rangelands are negatively impacted by climate variability and are vulnerable to adverse climate impacts. The strategy seeks to strengthen capacity to generate new empirical knowledge, technologies and agricultural support services that meet emerging development challenges caused by increased climate change and variability. Following the NCCRS, the NCP (Zimbabwe, Ministry of Environment, Water and Climate [MEWC], 2017) is the overarching document guiding the implementation of climate action in Zimbabwe. It aims to improve climate and weather early warning systems and enhance adaptation actions in the context of poverty and sustainable development. It also calls on the country to contribute to climate change mitigation by adopting a low-carbon development pathway. The policy calls for establishment of a National Climate Fund to enhance financial flows towards low-emission and climate-resilient development. Emphasis is also placed on cross-cutting areas for actions, including gender, children and youths and being cognizant of disproportionate climate change impacts on population segments.

Zimbabwe's Long-term Low Greenhouse Gas Emissions Development Strategy (LEDS) (2020–2050) (GoZ, 2022) was developed through a multisector, multistakeholder consultative process to provide a clear, economy-wide low-emission development pathway for the country. It lays the foundations for a functional, effective and sustainable domestic monitoring, reporting and verification (MRV) system for tracking low-emission development, and a low-emission financing strategy. The business-as-usual GHG emissions developed in the LEDS cover four IPCC mitigation sectors and are based on the assessment of 38 costed sectoral mitigation measures. There is one livestock GHG mitigation measure in the LEDS, i.e. improvement of feed to reduce CH_4 emissions from enteric fermentation.

The Zimbabwe Climate Smart Agriculture Framework (ZCSAF) (2018–2028) (Zimbabwe, MLAWCRR, 2018b) acknowledges that agricultural production and productivity in Zimbabwe have remained low due to several factors, including climate change-induced weather patterns, especially smallholder farming systems dependent on natural rain. The ZCSAF also contributes to the operationalization of Zimbabwe's NDC, which identifies CSA as a key response measure for climate change in agriculture. However, GHG mitigation is not the primary objective of this strategy; rather, it facilitates the integration of adaptation technologies to increase the resilience of ecosystems and farming communities. The World Bank (Milne, Mekonnen and Benitez Ponce, 2019) produced a comprehensive Climate Smart Agriculture Investment Plan (CSAIP) to complement the ZCSAF. The CSAIP is a climate change policy instrument well aligned with the goals and objectives of the NAPF, Vision 2030 and the TSP. It also considers the agriculture visioning exercise, climate change strategies, policies and guidelines. The CSAIP envisions a productive and sustainable agriculture and food system embedded in stable macroeconomic conditions and strong institutions. The CSAIP recommends technology packages and investments to climate-proof agriculture in different agroecological regions, including mitigation.

The Government released the National Climate Change Learning Strategy (2020–2030) (Zimbabwe, MECTHI, 2020b), focusing on agriculture and climate change education, and supporting the implementation of NDCs, the NAP, and other

climate change strategies and plans. It aims to strengthen the sector's capacity to create "a climate change literate, responsive and resilient nation by the year 2030" by mainstreaming climate change in education and improving the knowledge base on climate change in all sectors.

In 2022, the Government proactively responded to climate change impacts by launching the NAP (Zimbabwe, MECTHI, 2023a) to mainstream climate change into national and subnational planning processes, and in all economic and social development sectors. The NAP recognizes the centrality of livestock in rural adaptation and coping strategies, as well as its vulnerability to droughts. The NAP explicitly lists the livestock adaptation strategies and the cost of implementation.

Zimbabwe's Carbon Credits Trading (General) Regulations (2023) guide the institutional arrangements and requirements, appraisal and procedure for carbon credit projects in the country. The development and implementation of a comprehensive Carbon Trading Framework and a National Carbon Credit Registry and the implementation of a National Climate Change Fund was announced, when the regulation was introduced.

5.1.4. Natural resources and environmental policies

The National Environmental Policy and Strategies (Zimbabwe, Ministry of Environment and Natural Resources Management [MENRM], 2009) aims to avoid irreversible environmental damage and preserve biological diversity to sustain natural resources' ability to supply basic needs, enhance food security and reduce poverty. The policy has a component on air quality regulation in which the impacts of GHG emissions on climate change are acknowledged. The policy emphasizes GHG emission regulation in industrial and residential point sources, but not in agriculture or livestock point sources.

The National Water Policy (Zimbabwe, Ministry of Water Resources Development and Management [MWRDM], 2012) is a comprehensive instrument that outlines the strategies and actions required to efficiently manage the country's water resources. It provides a framework to guide development and investment decisions in the water sector, and outlines measures to improve access to water for all citizens. The policy was designed to address various challenges facing the water sector in Zimbabwe, including climate change, water scarcity and inadequate water infrastructure. The policy acknowledges the impacts of climate change on water supply, agriculture and other economic activities, but it is not specific to livestock. It recommends various measures and highlights the need to integrate climate change considerations into water resources management and planning processes, and promote climate-smart technologies and practices.

The National Biodiversity Strategy and Action Plan (Zimbabwe, MEWC, 2014), reviewed in 2014, highlights that high-yielding exotic breeds have led to genetic contamination of the adapted indigenous breeds. The policy seeks to introduce and promote indigenous breeds. It depicts that community-based animal and plant genetic resource management should be encouraged and supported for food security and conservation.

The National Forest Policy (NFP) (Zimbabwe, MECTHI, 2023b). The NFP recognizes the vital role of forests in mitigating climate change. The NFP aims to promote the sustainable management and conservation of forests for present and future generations. In addition, the policy focuses on promoting afforestation, reforestation, and restoration of degraded forest ecosystems. These mitigation strategies are critical in increasing the carbon sequestration capacity of forests. Overall, the policy plays an important role in addressing climate change by promoting sustainable forest management practices that support the conservation of forest ecosystems, while also enhancing the capacity of forests to mitigate the climate change impacts. The policy recognizes the role of deforestation and degradation in national GHG emissions and the threat from wildfires. However, it does not mention the NDCs' commitment to reducing wildfires in grassland.

5.1.5. Nationally determined contributions

Zimbabwe set the target of reducing the total GHG emissions by 40 percent in 2030 to 44.7 Mt CO_2eq, conditional on international support, and technology development and transfer. The target was developed from the baseline and projections for sectoral development based on the sectoral policies and growth plans, and a multistakeholder consultative process, and endorsed by the cabinet. The largest potential for reducing emissions comes from the AFOLU sector (-61 percent; 25.35 Mt CO_2eq) through natural forest restoration, and reducing grassland and forest land area burned. Fire suppression activities, which include enforced legislation on fire guards, live fencing, buffer zones, and reducing fuel load through hay bailing, have been prioritized to achieve the fire mitigation target by 2030 (GoZ, 2021). The barriers to active implementation of fire control measures include weak enforcement and conflicting policies, limited technical and technological capacity, insufficient funding and low levels of awareness.

Livestock GHG mitigation measures are currently lacking in Zimbabwe's revised NDCs due to a lack of appropriate data for mitigation assessment at the time of NDC revision. In line with national development priorities, livestock industry players have prioritized livestock adaptation measures in the country's first and revised NDCs. The revised NDCs provide details about the recent climate impacts on livestock health and disease outbreaks. The livestock adaptation

strategies include developing, implementing and scaling up climate-smart agriculture solutions, and strengthening the resilience of agricultural value chains and markets. The listed climate-smart solutions include using locally adapted livestock breeds, livestock diversification, improving livestock management, fodder production and livestock feeding strategies, silvopastoral systems, and early warning and climate-related disaster risk reduction systems, as well as reduction of unprescribed burning in savanna grazing lands.

5.2. POLICY COHERENCE FOR LIVESTOCK MITIGATION AND ADAPTATION ACTIONS

Zimbabwe's policy environment supports a range of mitigation and adaptation measures for the livestock sector, with a more robust focus on adaptation than mitigation. Table 5 extracts the detailed livestock mitigation and adaptation measures from each policy document, and provides a score to describe the policy's level of coherence with SDG 13 on climate action, and the level of support towards specific climate change adaptation and mitigation measures in the livestock sector. The scoring system consists of four levels of coherence: 3 = high, 2 = partial, 1 = limited and 0 = none. The highest score (3) describes a strong policy alignment with climate action related to the livestock sector. This means the policy devotes specific attention to climate change adaptation and/or mitigation in the livestock sector, and the policy includes specific activities, measures and approaches for livestock climate action. Policies are scored separately for their mitigation alignment and adaptation alignment. Policies scoring "0" do not support livestock mitigation and adaptation measures. The scoring system is described in the methodology in Table 1.

The adaptation strategies primarily aim to enhance the resilience of livestock production systems to the growing impacts of climate change. These include improving livestock productivity and health through measures such as developing climate-resilient pastures, encouraging diversification in livestock systems, increasing water points for livestock, and intensifying disease control programmes. Notably, agriculture and livestock sector-specific policies demonstrate very good alignment with adaptation needs, scoring an average of 2.5 on a scale where 3 indicates the highest coherence with and support of livestock climate action. For example, the NDS1, the Livestock Recovery and Growth Plan and the Agriculture, Food Systems and Rural Transformation Strategy score 3 for adaptation alignment, as they prioritize climate-smart practices such as introducing drought-tolerant livestock breeds, expanding farmer extension services, and establishing fodder banks to ensure feed availability during droughts.

Zimbabwe's socioeconomic development policies have enhanced climate resilience, and risk and disaster management. The Food and Nutrition Security Policy (2012) and the TSP focus on livestock sector resilience through livestock insurance schemes, disease surveillance, and early warning systems for droughts and livestock diseases. These efforts aim to reduce the vulnerability of the livestock sector to climate-induced shocks and ensure a stable supply chain. However, these policies focus primarily on adaptation, with little attention paid to mitigation, as evidenced by an average adaptation score of 2 and a significantly lower mitigation score of 0.2. The overarching socioeconomic goals do not include provisions for reducing GHG emissions in the livestock sector, highlighting a gap in comprehensive climate action.

On the mitigation side, Zimbabwe is gradually beginning to incorporate strategies to reduce GHG emissions from livestock, although these efforts are less advanced than adaptation initiatives. Livestock sector mitigation strategies generally focus on reducing CH_4 emissions from enteric fermentation, and manure management. For example, the Long-term LEDS emphasizes improvement of livestock feed quality to lower CH_4 emissions from ruminants. This strategy aligns with broader efforts to develop sustainable grazing systems and pasture management practices, which also contribute to reducing emissions. However, the agriculture and livestock policies score only 1.3 for mitigation. While emissions reduction and carbon sequestration objectives are acknowledged, these policies require a more robust integration of mitigation targets and clearer implementation strategies.

A key area where Zimbabwe has made progress in both mitigation and adaptation is climate-smart agriculture practices. The CSAIP and the ZCSAF support climate-resilient livestock production by promoting better feed management, sustainable grazing, fodder production systems and diversification of livestock systems. These efforts contribute to both adaptation (by ensuring food security for livestock during climate extremes) and mitigation (by enhancing the carbon sequestration potential of grazing lands). The CSAIP explicitly addresses the GHG mitigation opportunity of various interventions and describes investment opportunities for their implementation, scoring 3 in adaptation and mitigation policy alignment.

Despite these efforts, specialized climate change policies continue to show uneven progress. While climate change policies such as the NCCRS and the NAP have the highest alignment with livestock sector adaptation needs, scoring an average of 2.6, their mitigation focus remains limited, with a lower score of 1.7. These policies list numerous interventions but often lack the specificity required for livestock GHG mitigation, which reduces their effectiveness in addressing the sector's mitigation potential. The CSAIP stands out as an exception, since it is the only climate policy that explicitly considers both mitigation and adaptation in the livestock sector.

Natural resource and environmental policies, which play a critical role in ensuring sustainable land and water use for livestock, are the least aligned with livestock sector needs, scoring only 1 for adaptation and 0.8 for mitigation. These policies provide limited coverage of livestock-related climate change issues, indicating that more work is needed to integrate livestock considerations into natural resource management frameworks.

In conclusion, Zimbabwe's national policies show essential strides in addressing livestock sector adaptation needs but have gaps in terms of incorporating mitigation strategies. The highest coherence with livestock adaptation is found within climate change policies, which score an average of 2.6, and within agriculture and livestock policies, scoring an average of 2.5. Socioeconomic development policies provide partial support with a score of 2. However, mitigation measures are limited, with average scores of 1.7 for climate change policies, 1.3 for agriculture and livestock policies, and 0.8 for natural resource policies. Moving forward, better integration of mitigation strategies will be essential, particularly in financing mechanisms, capacity building, and establishing more robust monitoring and reporting frameworks to track progress. Prioritizing these areas will be critical in enhancing Zimbabwe's overall climate response in the livestock sector.

TABLE 5
Livestock and climate objectives in the national policy environment, and mitigation and adaptation scoring

Policy document	Policy objectives: climate	Policy objectives: livestock	Adaptation and mitigation strategies	Adaptation score	Mitigation score
Socioeconomic development policies				**Average: 2**	**Average: 0.2**
Food and Nutrition Security Policy (2013)	Implement sustainable food production strategies that promote enhanced production in the context of managing risk caused by climate change.	Increase agricultural production capacity and diversification – crops including indigenous small grains and livestock – among farmers, especially women and smallholder farmers.	Appropriate financial credit schemes; conservation agriculture; promotion of drought-resistant varieties; and investment in cost-effective disaster preparedness and mitigation strategies that increase the resilience of poorer households, even during drought.	2	0
Zim Asset (2013–2018)	Promote alternative energy sources (biogas, solar and wind); and encourage and enforce the use of solar energy for lighting and heating.	Re-establish financial support for agriculture so that farmers will increase production, productivity and product quality; restock the national herd; and provide extension service support to farmers.	Institute measures for livestock restocking to all beneficiaries of the Land Reform Programme; establish livestock breeding and multiplication centres; strengthen livestock pest and diseases surveillance programme; strengthen livestock research and extension services; and implement livestock drought mitigation programmes.	2	0
TSP (2018–2020)	"Taking urgent action to combat climate change and its impacts", consistent with SDG 13; and promote climate-resilient water management systems, focusing on both crop and livestock production, cognizant of the peculiarities of the country's ecological regions.	Promote measures supportive of full recovery, in terms of the size and quality of the national herd, with accompanying benefits for improved supply along the livestock value chain, locally and internationally.	Enforce animal movement control regulations to stop the occurrence and spread of FMD from high-risk areas (red zones) to low-risk areas (green zones); target livestock comprehensive insurance, providing cover for epidemics in cattle; and support irrigation rehabilitation and development.	2	0
NDS1 (2021–2025)	Environment and climate protection is a cross-cutting issue. Strategies to improve climate action include: prioritizing the mainstreaming of climate change and related financing in all national programmes; strengthening early warning systems; and promoting climate-smart innovations and technology transfer.	Prioritize animal health and production through strengthening farmer knowledge, skills in livestock production and health to enhance productivity through various strategies. Increase beef production from 49 115 tonnes in 2020 to 110 000 tonnes by 2025.	Upscale hay cutting, develop pasture green belts and create forage banks; promote on-farm feed formulation using cassava and cow peas to produce survival rations; increase watering points for livestock; localize production of livestock inputs, and veterinary vaccines and medicine; intensify dipping programmes and blitz tick grease application to prevent and control entry and outbreaks of animal diseases; and strengthen implementation measures against tsetse flies.	3	1
NGP (2013–2017)	Increase gender responsiveness of environment and natural resources management strategies, and in climate change adaptation and mitigation initiatives.	None	Build the capacity of state and non-state development agencies in gender mainstreaming in environment and climate change policies, programmes and national environmental action plans; and support interventions aimed at increased participation of both women and men in the sustainable utilization of natural resources for economic benefits, including opportunities for carbon trading.	1	0

(Cont.)

TABLE 5
Livestock and climate objectives in the national policy environment, and mitigation and adaptation scoring (continued)

Policy document	Policy objectives: climate	Policy objectives: livestock	Adaptation and mitigation strategies	Adaptation score	Mitigation score
Agriculture and livestock policies				**Average: 2.5**	**Average: 1.3**
ZAIP (2013–2017)	Climate change adaptation: increasing the area under sustainable forestry and wildlife management.	Sustainable increase in livestock productivity in Matabeleland based on the regional comparative advantage; facilitate capacity building in sustainable production of livestock.	Crop and livestock insurance schemes; mobile-based crop and livestock price dissemination; rehabilitation of government livestock facilities; livestock development (breeding stock); design manuals for best practices in crop and livestock production; water and irrigation infrastructure rehabilitation; and reviewing legislation and regulations to compel tobacco farmers to plant trees to reduce depletion of carbon sinks due to deforestation.	2	1
NAPF (2019–2030)	Mainstream climate change impacts in all programmes and subsectors, and mobilize funds for climate change adaptation and mitigation programmes; enhance the resilience of agriculture production systems to climate change, and pest and disease attacks.	Increase agriculture's contribution to the GDP through productivity improvements in the crop, livestock, forest and fisheries sectors.	Promote diversification of crops and livestock, improve access to climate information and increase use of climate-smart technologies, crop, livestock and drought insurance, and disaster risk reduction and management.	2	1
Agriculture, Food Systems and Rural Transformation Strategy (2020–2024)	Invest in productivity-enhancing technologies, including improved seeds and animal breeds adapted to the changing climate; and build a USD 14 billion, modern, technology-driven, diverse, resilient, inclusive and climate-smart agriculture sector.	Increase crop, livestock and fish production and productivity for national food and nutrition security, and for food sovereignty; and broaden and diversify agricultural markets and trade.	Disease control and surveillance programme for January disease, FMD and Newcastle disease; construct game fences and rehabilitation of dip tanks; develop the beef, dairy, poultry, and goats and piggery value chains; help households build resilience to climate shocks through a number of strategies, including building of small dams and nutrition gardens.	3	1
Livestock Recovery and Growth Plan (2020)	Develop a small stock growth plan for climate adaptation; promote goat milk production in order to climate-proof dairy; and explore and promote climate-smart traditional grain (sunflower, sorghum and cowpea) -based feed formulations.	Enhance growth in population and milk production by reviving smallholder dairy and building the large-scale dairy herd; commercialize small stock production through genetic improvement and increasing herd sizes; and promote establishment of livestock business centres to champion all livestock value chain development issues.	Establish a pasture green belt of irrigated pastures along rivers and certain water bodies in the drier areas of the country; create fodder banks by growing climate-smart forages, e.g. sorghum, prickly pear, cassava and cow peas; cut and produce hay bales in high-rainfall areas for supplying supplementary feed to drier parts of the country; FMD fencing and vaccination programme targeting animals in areas adjacent to national parks; rehabilitate and build new dip tanks and drill boreholes to improve animal health and production.	3	2
Climate change policies				**Average: 2.6**	**Average: 1.7**
NCCRS (2015)	Mainstream climate change in all key sectors of the economy to ensure that each sector implements adaptation and mitigation actions; and promote resource use efficiency and less carbon intense pathways in all economic activities.	Strengthen the capacity to identify and promote adoption of indigenous and improved livestock breeds that are tolerant to climate-related stresses; and establish monitoring systems for greenhouse gas emissions in agricultural systems and support mechanisms for their reduction.	Strengthen the capacity to identify and promote adoption of indigenous and improved livestock breeds that are tolerant to climate-related stresses; strengthen early warning systems on cropping season quality, rangeland conditions, droughts, floods, disease/ pest outbreaks and wildlife movement in order to enhance farmer preparedness; establish monitoring systems for GHG emissions in agricultural systems and support mechanisms for their reduction; control CH_4 emissions from livestock, mainly through on-farm anaerobic digestion of manure from cattle and pigs.	3	2
NCP (2017)	Reduce vulnerability to climate variability and climate-related disasters by strengthening adaptive capacity; and accelerate mitigation measures by adopting and developing low-carbon development pathways.	Promote adoption of improved livestock breeds that are tolerant to climate-related stresses.	Ensure improved water supply for livestock, wildlife and the environment in line with the changing climate; strengthen implementation of the drought management framework for the livestock sector; promote and regulate crop and livestock weather-indexed insurance; strengthen the capacity to identify and promote adoption of improved livestock breeds that are tolerant to climate-related stresses; establish monitoring systems for GHG emissions in agricultural systems and support mechanisms for their reduction in line with the NDC; promote good grazing management and feeding practices; promote training and extension support to allow adoption of good management practices for grasslands, including prescribed burning and on-farm by-products and reduce uncontrolled burning.	3	1

(Cont.)

TABLE 5

Livestock and climate objectives in the national policy environment, and mitigation and adaptation scoring (continued)

Policy document	Policy objectives: climate	Policy objectives: livestock	Adaptation and mitigation strategies	Adaptation score	Mitigation score
Climate change policies				**Average: 2.6**	**Average: 1.7**
LEDS (2020–2050)	GoZ is committed to taking urgent action to mitigate and adapt to the effects of climate change. As a Party to the UNFCCC, the country seeks to contribute to the ambitious global mitigation goals agreed under the Paris Agreement. The LEDS explores measures that aim to reduce GHG emissions or increase carbon sequestration in forests and soils while contributing to socioeconomic development.	Improved animal feed avoiding overstocking of livestock in one area reduces CH_4 emissions from enteric fermentation.	Improvement of animal feed, to reduce emissions from enteric fermentation; and diversification of livestock to include goats and sheep, which can grant farmers and ranchers security in case of livestock disease or adverse weather conditions.	2	3
ZCSAF (2018–2028)	Improve access to and sustainable use of CSA inputs, tools and technologies and mainstream CSA into policy, regulatory and disaster risk management frameworks.	Increase use of climate-smart farm practices.	Diversified crop/livestock systems, including beekeeping and aquaculture; grazing management, pasture improvement and stock management, including use of feedlots for efficient finishing of livestock; fodder planning, production and preservation, including nutrient enhancement of crop residue and baling of fodder; use of artificial intelligence technology to introduce new livestock genetics; shift towards organic nitrogen sources such as legume intercrops, rotations or fallow/cover crops; and fire management.	3	1
CSAIP (2019)	Ensure that the agricultural sector is resilient to climate shocks; and achieve a sustainable and evidence-based agricultural sector that reduces GHG emissions through carbon conservation and carbon sequestration.	Upgrade to commercial breeds and management practices, to increase productivity and reduce emissions; improve fodder by introducing velvet beans (Mucuna pruriens) as supplemental feed for communal cattle and promote goats as replacement livestock.	Improved feed and fodder production and investment in alternative feeding systems; climate-resilient breeding programme and extension services; investment in *in situ* water harvesting and small-scale water infrastructure to enhance crop and livestock production; commercialization of livestock in the smallholder farmer sector.	3	3
National Climate Change Learning Strategy (2020)	Mainstream climate change in all education curricula at all levels; promote innovations and skills development in climate change mitigation and adaptation across all sectors of the economy; and ensure that gender is mainstreamed in all climate change management interventions.	Promote climate-smart agriculture practices in all farming communities in Zimbabwe.	The Zimbabwean citizens should have access to information on climate change impacts and/or opportunities to allow for informed decision-making in order to mitigate and adapt to climate change.	1	1
NAP (2023)	Integrate climate change adaptation into development policies, strategies, plans, programmes and activities.	Strengthen and enhance implementation of policies, plans and strategies on crop and livestock production systems.	Enhance training of farmers and other stakeholders in climate-smart livestock production systems, including diversification; and upscale research, development and uptake of drought-tolerant livestock varieties.	3	1
Natural resources and environment policies				**Average: 1**	**Average: 0.8**
National Environmental Policy and Strategies (2009)	Promulgate regulations to control gaseous and particulate emissions from the point source; and promulgate regulations to discourage widespread and unnecessary deforestation, and provide incentives to encourage reforestation or afforestation to increase carbon storage in vegetation and soils.	None	Promote use of appropriate conservation measures and support rehabilitation of degraded grazing lands.	1	1
National Water Policy (2013)	Integrate climate change into all water resource planning and design activities.	None	Improve water conservation, enhance water storage and distribution infrastructure, and promote sustainable use of water resources.	1	0
National Biodiversity Strategy and Action Plan (2014)	Integrate the implementation of conventions such as the Ramsar Convention and the UNFCCC.	Promote market-driven rearing and consumption of local livestock varieties.	Promote the production of drought-tolerant livestock; avoid conversion of grasslands and shrublands; and reduce emissions from deforestation and degradation.	1	1
NFP (2023)	This Forest Policy recognizes the multiple functions of and interests in forests, and is meant to ensure that they contribute effectively to national development, local economies and environmental protection, including climate change mitigation and adaptation. One objective is to enhance forest carbon sinks and build communities' resilience to climate change impacts through sustainable forest management.	None	Strengthen the resilience of communities to climate change through afforestation programmes, climate-smart agriculture and planting trees for fuelwood energy, as well as economic activities that include wood and non-wood forest products; and formulate and implement a comprehensive veld fire management framework that maintains the ecological integrity of forests.	1	1

Source: Authors' own elaboration.

6. Stakeholder consultation

6.1. STAKEHOLDER ENGAGEMENT IN LIVESTOCK CLIMATE ACTION

The survey elicited responses from stakeholders ranging from public sector institutions, non-governmental organizations (NGOs), farmers, the private sector and individuals involved in livestock value chains (Table 6). Government stakeholders are typically regarded as essential actors, although the extent of their involvement can vary. The Zimbabwe National Statistics Agency (ZIMSTAT), for instance, is vital for providing reliable livestock data, but may be neutral, with little or no influence on national livestock climate action. The primary stakeholders are the farmers who, as owners and caretakers of livestock, bear the brunt of impacts of climate change on livestock production. Their decisions and activities significantly influence GHG emissions. They stand to gain more from adaptation and mitigation measures. However, awareness of livestock-related climate policies and actions is limited at the individual farmer level. Farmers were conversant with general policies, such as National Vision 2030 and NDS1. The NGO sector is made up of several players. Their awareness of climate change is very high, even though some are involved in programmes or projects that are at odds with mitigating climate change. An example is promoting and propagating large exotic breeds at the expense of local and adapted breeds.

TABLE 6
Stakeholder mapping for livestock climate action

Stakeholder	Subgroup	Type	Scale	Stake/interest	Type of involvement	Initial attitude towards livestock climate action	Effect from livestock climate action	Influence in livestock climate action	Interest total score	Knowledge of climate livestock policies	Knowledge of livestock climate action	Engagement in livestock climate action
					Information/ consultation/ involvement/ collaboration/ decision-making	Positive/ neutral/ negative	Score: 1–3 1 – Low 2 – Moderate 3 – High			Score: 1–3 1 – Low 2 – Moderate 3 – High		
Government	CCMD	Public institution	National	Coordination of public climate change policies and compilation of national reports for UNFCCC	Decision-making	Positive	1	2	3	3	1	2
	ZIMSTAT	Public institution	National	Livestock statistics	Information	Neutral	1	1	2	1	1	1
	DLR	Public institution	National	Research on livestock adaptation mitigation and compilation of GHG emissions	Decision-making	Positive	1	3	4	3	3	3
	Department of Veterinary Services	Public institution	National	Animal disease surveillance and prevention	Involvement	Positive	1	2	3	2	2	2
	Division of Livestock Production and Development	Public institution	National	Livestock development and extension	Involvement	Positive	1	3	4	3	2	3
	Extension services	Public institution	National	Direct interaction with farmers and other stakeholders	Involvement	Positive	2	3	5	2	2	2
	Environmental Management Agency	Public institution	National	Environmental education and awareness, fire prevention and law enforcement	Consultation	Positive	1	2	3	2	2	1

(Cont.)

TABLE 6
Stakeholder mapping for livestock climate action (continued)

Stakeholder	Subgroup	Type	Scale	Stake/interest	Type of involvement	Initial attitude towards livestock climate action	Effect from livestock climate action	Influence in livestock climate action	Interest total score	Knowledge of climate livestock policies	Knowledge of livestock climate action	Engagement in livestock climate action
					Information/ consultation/ involvement/ collaboration/ decision-making	Positive/ neutral/ negative	Score: 1–3 1 – Low 2 – Moderate 3 – High			Score: 1–3 1 – Low 2 – Moderate 3 – High		
Livestock producers	Producer organizations	Private voluntary organizations	National	Farmers' lobby groups, livestock marketing, etc.	Involvement	Positive	2	3	5	2	2	2
	Farmers	Private	Individual	Livestock keepers	Involvement	Neutral	3	3	6	1	1	2
Academic/ research	Universities	Public institutions	National/ provincial	Climate livestock research and training of livestock practitioners at higher levels	Involvement	Positive	1	3	4	3	3	2
	Agricultural colleges	Public institutions	National/ provincial	Training of livestock practitioners at lower levels	Information	Positive	1	2	3	2	2	1
	Private research organizations	Private organizations	Private interests	Livestock research and development	Consultation	Positive	3	2	5	3	3	3
NGOs	Local	Private voluntary organizations	District/ national	Livestock development	Consultation	Neutral	2	3	5	2	2	1
	International	International organization	National/ international	Livestock development, livestock emergency aid and restocking	Consultation/ involvement/ collaboration	Positive	1	3	4	2	2	2
Local authorities	Rural district councils	Public institutions	District	Infrastructure development and maintenance, leviers, etc.	Information/ consultation	Neutral	1	3	4	1	1	1
	Traditional leadership	Public institutions	Local area	Custodians and enforcers of traditional norms	Consultation	Neutral to negative	2	3	5	1	1	1
Private sector	Abattoirs	Private organizations	Provincial/ district/ municipal	Slaughter and marketing of livestock	Consultation/ collaboration	Neutral	1	2	3	1	1	1
	Milk processors	Private organizations	National/ provincial	Markets for milk and selling milk products	Consultation/ collaboration	Neutral	1	2	3	1	1	2
	Veterinary drug suppliers	Private organizations	District	Purveyors of animal health drugs	Consultation	Neutral	1	2	3	1	1	1
	Feed manufacturers	Private organizations	National/local	Suppliers of livestock feed	Consultation/ collaboration	Positive	1	3	4	2	2	2
	Banks/insurers	Private organizations	National	Financial services to livestock value chains	Consultation	Neutral	1	1	2	1	1	1

Source: Authors' own elaboration.

6.2. BEST PRACTICES TO ENHANCE LIVESTOCK CLIMATE ACTION

During the consultation workshop, stakeholders discussed key interventions to reduce GHG emissions and enhance resilience in the livestock sector, as well as challenges and needs for implementation. Table 7 details the list of all mitigation and adaptation measures and their challenges and needs for implementation.

TABLE 7

Best practices and key interventions to reduce GHG emissions and enhance climate change adaptation in Zimbabwe's livestock sector, and challenges and needs for successful implementation and upscaling

Adaptation and mitigation interventions	Challenges to successful implementation	Needs for upscaling and implementation
Livestock breeding • Promotion of indigenous and locally adapted breeds through conservation of indigenous breeds at national research institutes and stud breeders, and making them available to farmers; use of artificial insemination to propagate indigenous and adaptable breeds; and ecological matching of breeds	• Policy gaps, i.e. absence of breeding policies and technologies • Low genetic potential in nondescript breeds due to uncontrolled breeding and inbreeding • Lack of farmer motivation, resulting in slow adoption of climate-smart practices	• Human resource development (capacity building) • Investment in research and extension infrastructure • Upgrading of indigenous breeds by introducing high-performing indigenous bulls in communal areas • Awareness-raising on climate action and tapping into carbon credit trading
Livestock health • Promoting dip tank rehabilitation and local production of vaccines (reducing the prevalence of diseases and parasites would generally reduce emissions intensity as healthier animals are more productive, and thus produce lower emissions per unit of output) • Use of ethnoveterinary and herbal medicines for treating livestock diseases	• Uncontrolled movement of animals in communal grazing land due to conflicting livestock and land uses • Inconsistent dipping practices by farmers, making it difficult to effectively control ticks and tick-borne diseases • Unavailability and inaccessibility of vaccines • Ethnoveterinary products are still under development and efficacy has not been verified • Formulations of ethnoveterinary products unstable over time • Indigenous species take a long time to grow	• Development and maintenance of efficient disease management systems for surveillance and monitoring at the national and farm levels • Setup of local communities from existing institutions such as villages, wards and district committees, e.g. disaster risk reduction committees, to control grazing • Continuous training and awareness-raising among smallholder livestock keepers to dip more consistently to effectively control ticks • Mobilization by the Government of more investments in vaccine production • Enhanced policy enforcement to improve the availability and accessibility of vaccines • Testing and validation of commonly reported plant species for their antimicrobial activities *in vitro* to recommend effective preparations and treatments
Livestock nutrition • On-farm feed improvement programme • On-farm feed formulation • Production and conservation of drought-tolerant fodder crops – presidential forage production scheme • Fodder and Sunn hemp (Crotalaria juncea), hyacinth bean (Lablab purpureus), and velvet bean (Mucuna pruriens) mixture (deep root) carbon sequestration and high carbon intensity (soil fertility) • Hay bailing programme by AGRITEX to stoke fodder banks for dry season supplementation • Use of non-conventional low-carbon feed resources, e.g. mealworm- and insect-based protein sources such as the black soldier fly • Use locally available, protein-rich feed resources, e.g. bush meal from masekesa, acacia and cactus	• Competition for land for producing food and feed crops • Drought-tolerant forage species adapt differently across regions • Scarcity of seed for forage crops • Inadequate water for irrigation • High vulnerability in the greater semi-arid region, i.e. the provinces of Masvingo, Matebeleland North and South and Midlands • Reduced forage productivity in the dry season • Lack of equipment, tools and technical capacity to measure and monitor GHG emissions resulting from interventions under implementation	• Conduct research to identify the region-specific adaptation characteristics of forage species • Conduct research on the nutrient composition of drought-tolerant forage plants and indigenous protein-rich feed resources, and GHG emissions from fed animals
Rangeland management practices • Veld reinforcement by introducing other nutritious species to maintain veld quality and improve harvest • Prescribed use of fires in grazing land • Holistic management of grazing land – stabilizes and promotes carbon sinks	• Insecure land tenure, which limits access to grazing land • Uncontrolled veld fires due to weak law enforcement • Vandalism of grazing infrastructure installed, e.g. theft of fences • Overgrazing and degradation of grazing lands in communal areas	• Review land tenure policies to guarantee tenure security • Strengthen enforcement of regulations and by-laws to control unprescribed burning of grazing lands • Awareness-raising and farmer training to promote adoption of conservative stocking densities
Herd management • Improving herd structures to reduce the number of non-productive animals through reduced mortality • Improved animal and herd fertility (calving rate), reduced age to slaughter, and increased offtake is an effective approach to reducing emissions per unit of milk or meat	• Complex livestock ownership at the household level hinders the culling or sale of unproductive animals	• Educating communities and raising awareness to facilitate mindset change with regard to unproductive animals and business acumen

(Cont.)

TABLE 7
Best practices and key interventions to reduce GHG emissions and enhance climate change adaptation in Zimbabwe's livestock sector, and challenges and needs for successful implementation and upscaling (continued)

Adaptation and mitigation interventions	Challenges to successful implementation	Needs for upscaling and implementation
Manure management • Composting manure and use of biogas digester (waste-to-energy) to use organic fertilizer (alternative to synthetic fertilizer created by applying organic fertilizer into the soil, further reducing emissions while maintaining productivity) • Spread fertilizer at the optimum time and with the best technology	• Biogas digesters are limited to large-scale commercial farms due to high upfront costs • Limited biomass feedstock in smallholder systems, which often keep small herds	• Adopt low-cost biogas equipment
Technology • Investments in climate-smart technologies, e.g. solar-powered boreholes and dip tanks	• Limited availability of financial resources to invest in climate-smart technologies	• Proactively mobilize financial resources, particularly climate finance • Tap into carbon credit trading
Market access • Enhancing market access for livestock products through establishing community livestock business centres, e.g. the Beef Enterprise Strengthening and Transformation project	• Limited market access options in regions flagged as FMD red zones (Lowveld) despite existence of healthy and market-ready cattle • Unfair meat grading system that is prejudiced against meat from indigenous breeds • ICT infrastructure	• Review beef marketing policies to allow the sale of deboned meat products in FMD red zones • Review the meat grading system
Policy • Developing climate-smart livestock policy frameworks through a bottom-up, multistakeholder approach • Climate-smart agriculture strategy (2018–2028) • Development of a carbon credit trading framework	• Policies do not clarify the climate change actions that should be implemented in the livestock sector • Unclear institutional arrangements • Funding and technical support for research needed	• Review livestock policies and strategies to incorporate climate change • Strengthen linkages/collaborative partnerships among institutions • Researchers should generate knowledge to inform the implementation of policies and actions

Source: Authors' own elaboration.

6.3. STAKEHOLDER RECOMMENDATIONS TO ENHANCE LIVESTOCK CLIMATE ACTION

- The lack of a multistakeholder platform for sharing information on experiences, innovations and best practices in livestock and climate change issues was perceived as one of the biggest challenges faced by livestock industry players in Zimbabwe. As such, stakeholders raised the need in the country to **establish a platform for continuous engagement and coordination**. The DLR Directorate volunteered to take the coordination role, and there is an opportunity to receive coordination support from the Participatory Ecological Land Use Management Association.
- There are inconsistencies in livestock population data among data providers, particularly between ZIMSTAT and the Department of Veterinary and Field Services. Given these data availability and quality issues, it was recommended to **conduct an extensive livestock census** to account for these discrepancies. **Strengthened institutional arrangements** between livestock data providers and government agencies, particularly the DLR and CCMD, will facilitate the regular provision of data for ongoing reporting of livestock climate action.
- **Enhance the flow of information on livestock climate action from national coordinating institutions, such as the Agricultural Advisory Services, Livestock Production and Development Department, and the Department of Veterinary and Field Services, to local and farm levels, to support awareness and action in this emerging area.** This involves identifying and engaging with existing local-level institutions involved in livestock development work, to create a communication channel as an entry point to understand communities' priorities and needs, and raise awareness on livestock and climate change.
- The country still lacks substantial knowledge in various livestock and climate change areas. Academic and research institutions need to **generate local knowledge** about the impacts of climate change on livestock health and welfare, water and feed availability, quantitative indicators of adaptation, and mitigation actions. Research is also needed to understand the limitations of the widespread adoption of climate-smart interventions by communal livestock keepers, to prevent the imposition of locally irrelevant interventions on farmers, and to inform climate change incorporation in livestock policy development.

- **Diversify export markets for beef to improve market access for farmers in FMD red zones**. Currently, it is difficult for farmers in FMD red zones to export their beef to the European Union because of the existing export ban for beef from its countries. However, most beef cattle in the country are found in the FMD red zone, i.e. Natural Regions III to V, and the area generally has very few abattoirs. To help address this challenge, participants recommended that the Government review its FMD-market access policy to use a product-based system in which deboned meat from animals without FMD in the FMD red zones can be sold for export. **The Livestock and Meat Advisory Council, the Division of Livestock Production and Development and FAO** are currently working on these issues and will provide them with the updated policy framework.
- The stakeholder consultation workshop emphasized the need for capacity building for researchers, experts and key stakeholders. Key experts should undertake **training of trainers** courses to improve their understanding of methodologies, tools and databases used in climate change transparency reporting. Transparency issues related to the livestock sector in Zimbabwe include the Tier 2 GHG inventory, and mitigation and adaptation actions in NDCs. **Training of key stakeholders** such as data providers, experts/researchers and youth by trained experts will be necessary to build institutional memory and prepare the next generation for livestock climate action.
- Stakeholders were concerned about the negative impacts of recurring veld fires on grazing land conditions, and the absence of a robust approach to monitor and manage fires and GHG impacts. Reducing areas burned by veld fires is a top priority in Zimbabwe's NDCs, but information on the amount of carbon sequestered in the country's grazing lands is currently lacking. Livestock sector experts should collaborate with the Forestry and Other Land Use working group of the national GHG inventory Forestry Commission, the **Chemistry and Soil Research Institute** and the University of Zimbabwe in **mapping the carbon sequestration potential in local grazing lands**. Such information will improve stakeholders' knowledge on the inventory of carbon sinks in their grazing lands, and they can use it information when seeking carbon trading finance.

7. Conclusion and recommendations to enhance livestock climate action

This section summarizes the findings and recommendations from the policy analysis, the newly developed Tier 2 GHG inventory for cattle emissions, and stakeholder consultation and validation workshops held in November and December 2023.

The policy analysis revealed that Zimbabwe's national policy framework provides a good level of support towards climate change adaptation measures for livestock. However, strategies for mitigating livestock-related GHG emissions remain underdeveloped, and the alignment of livestock priorities with both adaptation and mitigation efforts is incomplete. Integrating climate change into livestock policies and strategies more effectively is critical to harmonizing policy objectives and fostering synergies for sustainable development. Many adaptation strategies also offer opportunities to reduce GHG emissions, underscoring the potential for integrated approaches.

In 2023, Zimbabwe developed its Tier 2 GHG inventory for cattle emissions, providing the baseline to assess the mitigation potential of specific livestock management interventions and policies. This provided an opportunity to incorporate livestock-related actions into future NDCs. Despite this progress, there are gaps in policy and institutional frameworks, particularly in linking livestock adaptation strategies outlined in NDCs with the necessary capacities for implementation across livestock value chains. Additionally, the lack of mechanisms to finance NDC implementation hampers progress.

Livestock policymakers require support to embed climate-smart livestock programmes planned under NDCs into policies, strategies and projects that align with national priorities. Furthermore, MLAFWRD should pursue new policy frameworks to meet the livestock goals set in the NDCs. Stakeholder involvement remains low, limiting the effective planning and implementation of NDC policies and measures. Limited understanding of climate-smart livestock practices among stakeholders could delay the adoption of these practices. There is a need for more robust institutional arrangements to plan, implement, monitor, report on and verify livestock climate action.

Improving stakeholder engagement is crucial. Livestock industry players, farmers, the private sector and local institutions should be actively involved in planning and executing adaptation and mitigation measures. Their involvement has been limited to consultations during NDC preparation, with only a few senior government officials serving as focal points for agriculture and livestock adaptation. Data gaps persist, particularly in monitoring livestock adaptation outcomes and defining relevant indicators.

The current Tier 2 GHG inventory, developed using the best available data, still needs comprehensive and high-quality data on herd structure, production systems, feeding, and manure management practices. To reduce uncertainties in the GHG assessment, follow-up activities to collect detailed cattle performance data, especially in agropastoral and extensive beef systems, are essential.

Various government-led livestock development programmes have already implemented numerous climate-smart strategies, such as holistic grazing management, forage production, dip tank rehabilitation and genetic improvement programmes. However, their contributions to adaptation and mitigation goals have yet to be formally assessed and incorporated into the country's NDCs. Strengthening research to build an evidence base for these strategies is necessary to inform livestock climate action. Enhanced data accuracy, coordination, awareness and evidence-based policy will support climate action and sustainability in Zimbabwe's livestock industry.

Key recommendations from the stakeholder consultation workshop include:

- establishing a multistakeholder platform for coordination and knowledge-sharing;
- conducting a comprehensive livestock census to reconcile discrepancies in population data;
- strengthening communication channels from the national to local levels;
- addressing knowledge gaps through research on climate impacts and adoption barriers;
- diversifying beef export markets beyond the European Union;
- building capacity among experts and stakeholders on reporting methodologies and tools; and
- collaborating across sectors to map carbon sequestration potential in grazing lands.

Dissemination of study findings

To maximize the impact of this study, participants of the validation workshop recommended translating the study into local languages and disseminating it through various

channels, such as pamphlets, brochures, fact sheets, policy briefs and agricultural exhibitions. Social media platforms, radio broadcasts and websites of relevant ministries were also suggested as dissemination tools.

The study should serve as the foundation for applying for climate finance. Key actions include training livestock extension staff in data collection, GHG emissions assessment and reporting, and incorporating findings into academic curricula and research agendas. Research and training institutions can use the knowledge gaps identified to develop training manuals and innovate in livestock climate action.

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Annexes

Annex 1
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Annex 2
Workshop agenda

DAY 1	Tuesday 14 November 2023	
Time	**Topics**	**Speakers**
08.30–09.00	Registration	DLR FAO
	Session 0: Welcome and introduction	
09:00–09:30	**Introduction of participants and housekeeping**	Grace Tambo, DLR, MLAFWRD
09.30–10.00	**Welcome remarks:** Andrew Chamisa, DLR, MLAFWRD • Speech: FAO country representative • Guest speaker: Permanent Secretary, MLAFWRD	 Patrice Talla (FAO) Professor Obert Jiri
10.00–10.20	**Background and context for livestock climate action and workshop objectives**	Saskia Reppin, FAO headquarters
10.20–10.30	Q&A and plenary reflection	All
10.30–11.00	**Coffee break and group photo**	All
	Session 1: Livestock and climate change in Zimbabwe	
11.00–11.20	**Status, trends and outlook of the livestock sector (including development policies and strategies)**	Vimbai Zirenga, Strategic Planning and Business Development Directorate, MLAFWRD
11.20–11.40	**Climate change governance, policies and strategies (including NDCs)**	Dhoba Lovemore, CCMD
11.40–12.00	**Climate change in livestock systems in Zimbabwe (impacts, vulnerabilities, risk, etc.)**	Walter Svinurai
12.00–12.30	Q&A and plenary reflection	All
12.30–13.30	**Lunch**	All
	Session 2: Addressing climate change in livestock	
13.30–14.00	**Climate change adaptation in livestock systems, options to reduce GHG emissions, and enteric CH_4 mitigation**	Saskia Reppin, FAO headquarters
14.00–15.30	**Breakout group discussions** • What are the **best practices and key interventions** in Zimbabwe to reduce GHG emissions and enhance adaptation (mitigation and adaptation) in the livestock sector? • What are the **main challenges** of implementing climate action (**technical, institutional and policy perspective**) in the livestock sector? • What are the **needs** for addressing these challenges?	All
15.30–16.00	**Coffee break**	
16.00–17.00	**Plenary reporting and reflections** One rapporteur from each group will report back to the plenary	All
17.00	**End of Day 1**	

DAY 2	Wednesday 15 November 2023	
Time	**Topics**	**Speakers**
08.30–08.40	**Wrap-up of Day 1**	Nyasha Rugwete
	Session 3: GHGs from livestock systems	Moderation: Masunda
08.45–09.00	**Livestock activity data and herd parameters required for GHG assessment**	Roger Kamana, FAO headquarters
09.00–09.15	**National GHG inventory and MRV of GHG emissions**	Walter Svinurai
09.15–10.00	**Plenary discussion and reflection** • What are the **challenges** related to **data collection** and compilation for the Tier 2 GHG inventory of the livestock sector? • What is **needed** to improve livestock **activity data** and inform policy development? • What is **needed** to improve the **livestock MRV system**?	All
10.00–10.30	**Coffee break**	All
	Session 4: Livestock climate action in Zimbabwe (projects and programmes)	
10.30–10.50	**Climate-smart initiatives in selected value chains and the role of the private sector/farmer**	Peter Makumbe, Shangani Ranch
10.50–11.10	**Holistic grassland management**	Elias Ncube, Africa Centre for Holistic Management
11.10–11.20	**CSA and digitization for sustainable markets**	Desire Nemashakwe, Climate Finance Officer, FBC Holdings
	Session 5: Stakeholder engagement	Facilitated plenary discussion
11.20–12.00	**Stakeholder perspective on livestock climate action** Views from stakeholders on livestock climate action and their roles and responsibilities	All stakeholders
12.00–13.00	**Lunch**	All
13.00	**Field visit: Henderson Research Institute, Mazowe** Livestock climate action in practice: Dairy and beef systems	All
18.00	**End of Day 2**	

DAY 3	Thursday 16 November 2023	
Time	**Topics**	**Speakers**
08.30–08.40	**Wrap-up of Day 2**	Wisdom Gunzvenzve
08.40–09.00	**Plenary reflection from the field visit**	Blessed Masunda, University of Zimbabwe
	Session 6: Integrating livestock in national climate action and aligning with development objectives	
09.00–09.15	**Policy analysis on livestock climate action in Zimbabwe**	Walter Svinurai, University of Zimbabwe
09.15–09.30	**Introduction to the breakout session**	Saskia Reppin, FAO headquarters
09.30–10.30	**Breakout group discussion:** Formulate recommendations to enhance livestock climate action for Zimbabwe: • **Discuss the synergies and trade-offs** between livestock development objectives and climate action. • What **policies and technical interventions** are needed to achieve the alignment of livestock development and climate action? • Propose a **road map for the implementation** of livestock climate action.	All
10.30–11.00	**Coffee**	All
11.00–11.30	**Plenary reporting and discussion**	All
	Session 7: Call to action	
11.30–12.00	**Feedback and evaluation of the workshop**	All
12.00–12.30	**Plenary reflection, recommendations, key messages and the way forward**	All
12.30–13.00	**Closing remarks:** • FAO • Ministries	Andrew Chamisa, DLR, MLAFWRD FAO Zimbabwe
13.00	**End of workshop**	
13.00–14.00	**Lunch**	All

Annex 3
Survey questionnaire

SURVEY ON STAKEHOLDER ENGAGEMENT IN NATIONAL CLIMATE ACTION IN THE LIVESTOCK SECTOR

This short survey is being conducted in the context of the **stakeholder consultation on national climate action in livestock systems in Zimbabwe**, to take place in December 2023. The survey is being circulated among participating institutions and livestock stakeholders. The objective of this survey is to capture livestock stakeholders' awareness, knowledge and engagement in national climate action in the livestock sector. The collected information will be treated confidentially. A summary of the responses (no individual answers) may be presented during the workshop. Thank you for participating in this survey.

SECTION 0

Identification of respondent and other information

S0Q1	Name of respondent: [Free text]
S0Q2	Email: [Free text]
S0Q3	*Name of your institution: [Free text]
S0Q4	Position that describes your role in the institution:
S0Q5	*Sex: [Select one] 1. ☐ Male 2. ☐ Female 3. ☐ Other
S0Q6	*Which of the following categories best describes your institution? [Select one] 1. ☐ Ministry/department 2. ☐ Agency/board 3. ☐ Local authority 4. ☐ Local NGO 5. ☐ International NGO 6. ☐ Private company 7. ☐ Farmer/producer organization 8. ☐ Researcher/individual 9. ☐ University 10. ☐ Civil society 11. ☐ Development partner 12. ☐ Other (please specify):
S0Q7	*Please select your main area(s) of work: [Select all applicable] ☐ Agriculture ☐ Livestock ☐ Environment ☐ Climate change ☐ Education ☐ Sustainability ☐ Extension ☐ Finance ☐ Governance ☐ Statistics ☐ Other

SECTION 1

Awareness around national livestock climate action

S1Q1	*Which of the following policy documents, strategies or action plans are you aware of? [Multiple selection] 1. ☐ Zimbabwe National Climate Change Response Strategy (NCCRS), 2014 2. ☐ National Climate Policy, 2017 3. ☐ Long-term Low Greenhouse Gas Emissions Development Strategy (LEDS), 2020 4. ☐ Climate Smart Agriculture Framework, 2018–2028 5. ☐ National Adaptation Plan (NAP) 6. ☐ National Vision 2030 7. ☐ Agriculture, Food Systems and Rural Transformation Strategy 8. ☐ Livestock Recovery and Growth Plan 9. ☐ Nationally Determined Contribution (NDC), 2015
S1Q2	*Did your institution contribute to any aspect of policy or action plan formulation? [Select one] 1. ☐ Yes 2. ☐ No **Skip**=> S1Q4
S1Q3	*If yes, which policy did you contribute to and how? [Free text]
S1Q4	*Which policies or strategies do you consider in your planning and development of annual action plans or projects? [Multiple selection] 1. ☐ Zimbabwe National Climate Change Response Strategy (NCCRS), 2014 2. ☐ National Determined Contribution (NDC), 2015 3. ☐ National Development Strategies I and II 4. ☐ National Adaptation Plan (NAP), 2023 5. ☐ Long-term Low Greenhouse Gas Emissions Development Strategy (LEDS) 6. ☐ National Climate Change Framework Policy (NCCFP), 2016 7. ☐ Climate Smart Agriculture Framework 8. ☐ Climate Smart Agriculture investment framework 9. ☐ National Climate Change Action Plan (NCCAP), 2018–2022 10. ☐ National Vision 2030 11. ☐ National Livestock Policy 12. ☐ Carbon Trading Framework 13. ☐ Agriculture, Food Systems and Rural Transformation Strategy 14. ☐ Other (please specify):
S1Q5	*In your opinion, do existing policies and strategies support the implementation of climate action in the livestock sector? [Select one] 1. ☐ Yes 2. ☐ No 3. ☐ Not sufficiently 4. ☐ Partially 5. ☐ Don't know } **Skip**=> S2Q1
S1Q6	*If yes, which interventions are supported in these policies? [Multiple selection] 1. ☐ Mitigations of methane (CH_4) from enteric fermentation 2. ☐ Mitigations of CH_4 from manure management 3. ☐ Adaptation and resilience 4. ☐ Mitigation of nitrous oxide (N_2O) and carbon dioxide (CO_2) 5. ☐ Carbon offsetting 6. ☐ None 7. ☐ Don't know
S1Q7	*What is needed for better integration of the livestock sector in national climate action? [Free text]

SECTION 2

Livestock climate action

S2Q1	*Does your institution support the promotion of sustainable practices in the livestock sector through any of the below? [Multiple selection] 1. ☐ Promoting climate-smart livestock practices 2. ☐ Promoting better livestock feeding 3. ☐ Supporting management at the farm level 4. ☐ Supporting increased livestock productivity and efficiency at the farm level 5. ☐ Promoting efficient manure management systems, including composting 6. ☐ Improving livestock genetics and breeding 7. ☐ Supporting sustainable grazing management ☐ Others (please specify): 8. ☐ None
S2Q2	*Does your institution promote on-farm biogas production? [Select one] 1. ☐ Yes, to generate energy for lighting and cooking 2. ☐ Yes, to reduce CH_4 emissions 3. ☐ Yes, for both 4. ☐ N/A 5. ☐ No
S2Q3	*Does your institution promote efficient organic waste and wastewater management to support circular bioeconomy for animal processing plants (e.g. milk collection centre/slaughterhouse)? [Select one] 1. ☐ Yes 2. ☐ No 3. ☐ N/A 4. ☐ No **Skip**=> S2Q6
S2Q4	*If yes, please specify how: [Free text]
S2Q5	*Does your institution promote climate-resilient livestock through any of the following practices? [Multiple selection] 1. ☐ Livestock insurance 2. ☐ Integrated livestock systems and agroforestry 3. ☐ Sustainable grazing management 4. ☐ Management of climate risks 5. ☐ Early warning systems 6. ☐ Offtake 7. ☐ None 8. ☐ Others (please specify): 9. ☐ Don't know
S2Q6	*What are the challenges and barriers to implementing and scaling up CH_4 mitigation interventions in the livestock sector? [Free text]

SECTION 3
Climate finance

S3Q1	*Is your institution aware of climate finance opportunities available at the national level? [Select one] 1. ☐ Yes 2. ☐ No
S3Q2	*If yes, please specify which: [Free text]
S3Q3	*Did your institution apply for any national or international climate finance? [Select one] 1. ☐ Yes 2. ☐ No 3. ☐ Don't know
S3Q4	*If yes, through which financing institution?
S3Q5	*What challenges do you see specifically for climate finance in the livestock sector? 1. ☐ Low private-sector investment 2. ☐ Risks posed by sector are too high 3. ☐ No finance options available for livestock 4. ☐ Difficult to develop bankable projects 5. ☐ Others (please specify):

SECTION 4
GHG inventory

S4Q1	*Do you know institutions that are responsible for carrying out the national GHG inventory? [Select one] 1. ☐ Yes 2. ☐ No **Skip**=> S5Q1
S4Q2	*If yes, which institutions contribute to the analysis of the national GHG inventory? [Free text]
S4Q3	*Does your institution conduct an assessment of the GHG emissions or carbon footprint of the livestock sector? [Select one] 1. ☐ Yes 2. ☐ No
S4Q4	*If yes, which tool is used? [Free text]
S4Q5	If yes, when did your institution start working on it? [Select one] 1. ☐ < 2 years ago 2. ☐ < 5 years ago 3. ☐ < 10 years ago 4. ☐ > 10 years ago or more

SECTION 5

Livestock Climate Change Action Plan

S5Q1	*Where do you see opportunities for your institution to support the development and implementation of a Livestock Climate Change Action Plan? [Multiple selection] 1. ☐ Develop database for main activity data 2. ☐ Develop country-specific emission factors for CH_4 and other GHGs 3. ☐ Support the accurate estimate of GHG emissions from the livestock sector 4. ☐ Develop mitigation scenarios 5. ☐ Raise awareness of farmers and other actors in the livestock value chain on climate change issues 6. ☐ Conduct research on CH_4 reduction 7. ☐ Conduct research on efficient feed use 8. ☐ Support coordination of activities 9. ☐ Don't know 10. ☐ Other (please specify):
S5Q2	Do you have any comments or information you would like to share with us? [Free text]
S5Q3	What are your expectations for the national stakeholder workshop? [Free text]

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