

Understanding the Paradox of Livestock Farming in Sub-Saharan Africa's Cattle Corridor: Empirical Evidence from Uganda

Henry Omara¹, Mark Kiiza²

¹Email: henomara@gmail.com,

Department of Environmental Management Pemba Maputo- Mozambique

²Correspondence Author¹ Email: buceiuganda@gmail.com

ORCID No. 0009-0001-0028-8126

Faculty of Social Science Kampala University, Kampala Uganda

Abstract : *Over the decades there has been a growing concern on the challenges of Livestock farming is a major source of livelihood, food security, and economic development in Sub-Saharan Africa. In Uganda, the cattle corridor accounts for a substantial share of the national livestock population and contribute significantly to rural incomes. This study examines the paradox of livestock farming in Uganda's cattle corridor by investigating the factors affecting grazing patterns, the adaptation strategies employed by livestock farmers, and the effectiveness of existing policy and institutional frameworks. The study adopted a mixed methodology to enable collection of both qualitative and quantitative data. A total 2033 Farmers were engaged in the study. These were scientifically selected from Cattle corridor region. Survey, interviews and focused group discussion was used. The findings show that farmers respond through a range of adaptation strategies, including herd mobility, pasture conservation, supplementary feeding, water harvesting, and livelihood diversification. While these strategies contribute to resilience, their effectiveness is constrained by inadequate financial resources, weak infrastructure, and limited institutional support. The analysis further reveals that although Uganda has implemented several livestock development policies and programs, challenges related to policy implementation, coordination, and resource allocation continue to undermine their effectiveness. The study concludes that sustainable livestock development in Uganda's cattle corridor requires integrated policy interventions that strengthen climate-resilient grazing systems, improve service delivery, and enhance institutional capacity. The recommends for Governments support, ongoing debates infrastructure, livestock breeding, modern farming systems and regional markets rural development in Sub-Saharan Africa.*

Keywords: livestock farming; cattle corridor; grazing patterns; adaptation strategies; policy effectiveness.

Introduction

Livestock farming is a cornerstone of rural livelihoods, food security, and economic development across Sub-Saharan Africa. The sector contributes significantly to household incomes, employment creation, nutritional security, and national gross domestic product (GDP), particularly in countries where agriculture remains the backbone of the economy (Ndhlovu, 2026). Among these countries, Uganda possesses one of the largest livestock populations in East Africa, with cattle production playing a central role in supporting rural communities and contributing to the national beef industry (Rathi, 2025). The livestock sector provides income to millions of households and serves as a source of wealth accumulation, social status, and resilience against economic shocks.

Despite its socioeconomic importance, livestock farming in Uganda continues to face substantial challenges that constrain productivity and sustainability. These challenges include recurrent livestock diseases, inadequate veterinary and extension services. The limited access to improved breeds and breeding technologies, declining pasture quality, water scarcity, poor market infrastructure, and increasing climate variability (Chatterjee et al., 2025). The effects of prolonged droughts and changing rainfall patterns have become particularly pronounced within Uganda's cattle corridor, a vast semi-arid and sub-humid zone stretching across the country and supporting the majority of the national cattle herd. These pressures have intensified competition for grazing resources, altered traditional grazing systems, and increased the vulnerability of pastoral and agro-pastoral livelihoods (Change (IPCC), 2022).

The cattle corridor represents a paradox in livestock development. Although it contains the country's highest concentration of cattle and possesses considerable potential for beef production, livestock productivity remains below its potential (Karikari et al., 2024). This contradiction raises important questions regarding the sustainability of grazing systems, the effectiveness of farmers' adaptation strategies, and the adequacy of existing policy and institutional responses. While previous studies have examined individual constraints such as drought, animal diseases, or market access, The limited attention has been given to understanding how these interconnected challenges collectively shape grazing patterns and livestock production outcomes across diverse ecological and production systems within the cattle corridor (Morrison & Toye, 2026).

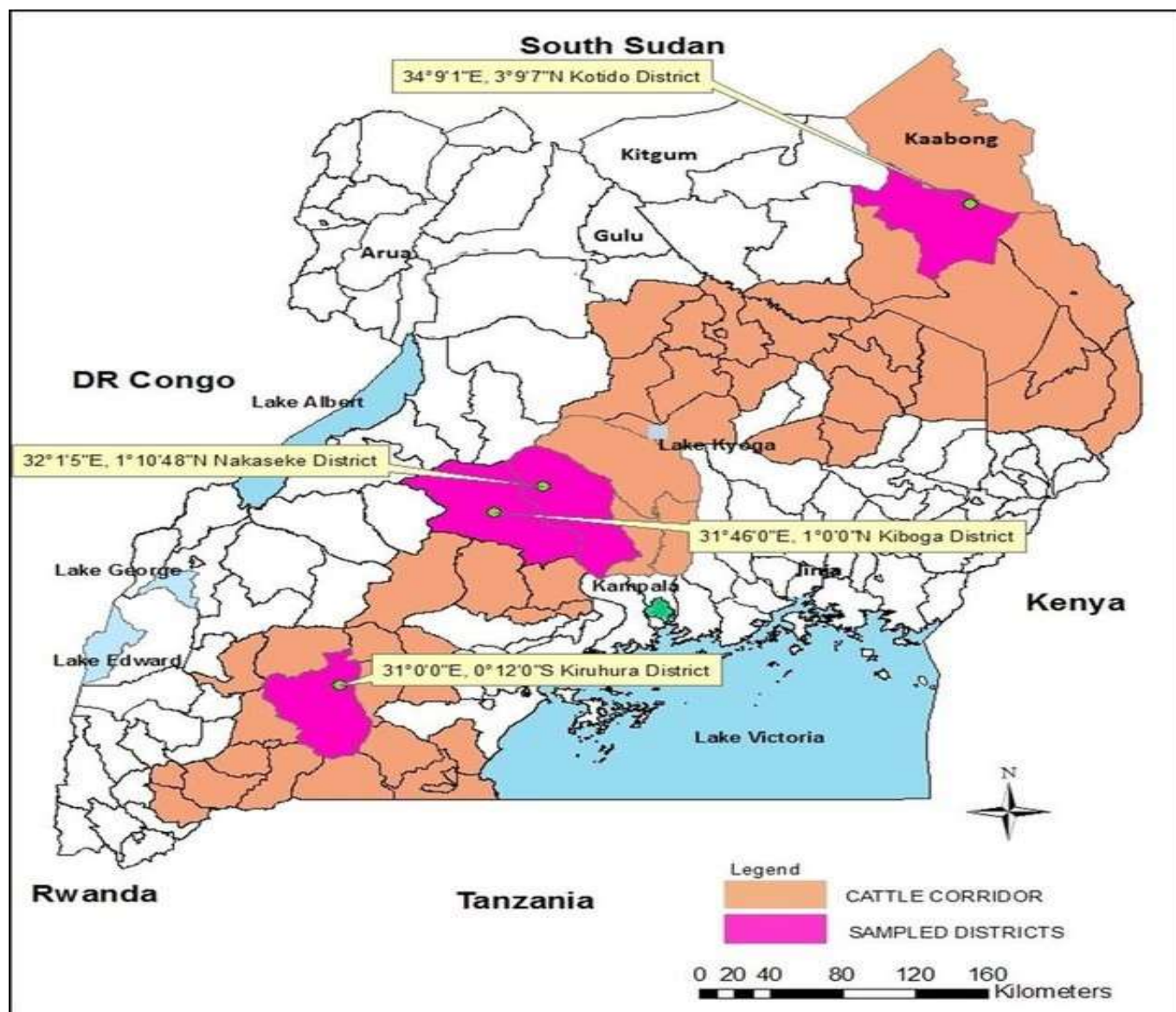
The present study addresses this knowledge gap by providing empirical evidence from three strategically selected districts Kiruhura, Nakaseke, and Kotido which represent distinct livestock production systems. It is clear within Uganda's cattle corridor Kiruhura is characterized by relatively commercialized ranching systems, Nakaseke by mixed crop-livestock production, and Kotido by predominantly pastoral and agro-pastoral livelihoods (Moritz et al., 2026a). Examining these districts together provides a

comprehensive understanding of how livestock farmers experience and respond to grazing-related challenges under varying socio-ecological conditions.

The study lies in its integrated assessment of livestock grazing challenges, farmer adaptation strategies, and policy effectiveness within a single analytical framework. Rather than examining these dimensions separately, the study explores the synergies and interactions among environmental pressures, farmer responses, and institutional support mechanisms (Sharma et al., 2026). This approach contributes to a more holistic understanding of livestock system resilience and offers insights into the persistent paradox of low livestock productivity in a region endowed with substantial livestock resources.

Specifically, the study aims to: (i) identify the challenges affecting livestock grazing patterns in Uganda; (ii) examine the strategies adopted by livestock farmers to address grazing-related challenges; and (iii) assess the effectiveness of policies and institutional frameworks supporting livestock farming in Uganda. The findings are expected to inform evidence-based policies and interventions aimed at strengthening climate resilience, improving livestock productivity, and promoting sustainable livestock development within Uganda's cattle corridor and other livestock-dependent regions of Sub-Saharan Africa.

MAP OF UGANDA INDICATING THE STUDY AREAS.



(Source Google Map retrieved 2 June 2026)

Methodology

This study adopted mixed-methods to enable collection of both qualitative and quantitative data required for the study (Patrick, 2021). The method was suitable; it enabled effective exploration of the variables under investigation. The study also used a case research design grounded in a multiple case study approach. The integration of mixed-methods and research design enabled the comprehensive findings of the variables (Poth, 2023).

These take posted into pragmatism philosophy that enabled epistemology and ontological stance to ease the study. These approaches eased the collection of both quantitative and qualitative data to provide a comprehensive understanding of the paradox of livestock farming in Sub-Saharan Africa's cattle corridor (Oyanedel et al., 2023). The case study design was appropriate because it allowed in-depth examination of livestock farming systems within real-life contexts across selected districts in Uganda.

Study Population

The target population comprised cattle farmers, pastoralists, and agro-pastoral households engaged in livestock production in the selected districts (Moritz et al., 2026b). These groups were considered appropriate because they directly participate in livestock production systems and experience the challenges and benefits associated with cattle farming in the region.

Key informants also included:

- District veterinary officers
- Extension workers
- Local government agricultural officers
- Community leaders involved in livestock governance

3.3 Sample Size and Sampling Techniques

The study involved a total sample of 2,046 respondents drawn from the three districts. These included Kiruhura, Nakaseke, and Kotido districts, which represent key livestock production zones within Uganda's cattle corridor, characterized by varying ecological and socio-economic conditions (O'Mara et al., 2023). The sample was scientifically selected from the targeted population of farmers from the study areas of Kiruhura, Nakaseke, and Kotido districts respectively.

A combination of probability and non-probability sampling techniques was used:

- **Stratified sampling** was used to ensure representation across districts and livestock production systems (pastoral, agro-pastoral, and sedentary farming).
- **Simple random sampling** was used to select household respondents (cattle farmers).
- **Purposive sampling** was used to select key informants and participants for qualitative data collection, including focus group discussions (FGDs) and interviews.

The large sample size ensured statistical representativeness and enhanced generalizability across the cattle corridor context of Uganda (Bhateja et al., 2026).

Data Collection Methods and Instruments

The survey method was used and structured questionnaires were developed and used to collect quantitative data from cattle farming households (Nations, 2022). These surveys captured information on:

- Livestock ownership and productivity
- Household income and livelihoods
- Access to veterinary and extension services
- Climate variability and grazing patterns
- Market participation and constraints

Key Informant Interviews (KIIs)

The interviews were used in process of data collection. This method proved effective and efficient in the process of data collection. Semi-structured interview guides were used to collect in-depth qualitative data from key informants such as veterinary officers and local leaders (A.K, 2023). These interviews explored institutional challenges, policy implementation gaps, and livestock management systems.

Focus Group Discussions (FGDs)

The focused group discussion method was employed in the process of the study. FGDs were conducted with selected cattle farmers in each district to capture community-level perceptions, indigenous knowledge, coping strategies, and socio-cultural dimensions of livestock farming (Fletcher & Reed, 2022).

Each FGD consisted of 6–10 participants to ensure meaningful participation and discussion depth and relevant information and resolutions were captured in the study.

Validity and Reliability

To ensure content validity, research instruments were reviewed by experts in agricultural economics and livestock systems (Rubino et al., 2023). A pilot study was conducted in a non-selected district with similar characteristics to refine the instruments.

Construct validity was ensured by aligning survey items with established theoretical frameworks on pastoral livelihoods and climate-livestock systems.

Reliability of quantitative instruments was tested using Cronbach's alpha coefficient, with a threshold of 0.70 or higher considered acceptable (Olayide et al., 2026). Consistency of qualitative data was ensured through triangulation across FGDs, interviews, and survey responses.

Data Analysis

The Quantitative data from questionnaires were coded and analyzed using statistical software (e.g., SPSS or STATA). Analysis involved:

- Descriptive statistics (means, frequencies, percentages)
- Inferential statistics (correlation and regression analysis)
- Comparative analysis across districts

These techniques were used to examine relationships between livestock farming practices and livelihood outcomes (Alizadeh, 2021). The Qualitative data from KIIs and FGDs were analyzed using thematic analysis. Data were transcribed, coded, and categorized into emerging themes such as:

- Livestock mobility and grazing systems
- Climate change adaptation strategies
- Institutional and policy constraints
- Socio-economic resilience mechanisms

NVivo or manual coding techniques were applied to organize qualitative insights.

Ethical Considerations

The study adhered to established ethical research standards:

- Ethical approval was obtained from a recognized institutional review board.
- Permission was secured from district authorities in Kiruhura, Nakaseke, and Kotido.
- Informed consent was obtained from all participants.
- Participation was voluntary, with the right to withdraw at any time.
- Confidentiality and anonymity of respondents were strictly maintained.
- Data was used solely for academic purposes.

The study faced several limitations:

- **Geographical constraints:** Accessing remote pastoral communities, especially in Kotido, was challenging due to poor infrastructure.
- **Seasonal variability:** Livestock mobility patterns varied across seasons, potentially influencing responses.
- **Response bias:** Some respondents may have over- or under-reported livestock ownership due to socio-economic sensitivities.
- **Language barriers:** Multiple local languages required translation, which may have slightly affected meaning during data collection.

- **Time and resource constraints:** The large sample size required significant logistical coordination. However despite these limitations, triangulation of methods helped improve the robustness of findings of this study and it was a successful

Results

The study found that livestock grazing systems in Uganda's cattle corridor are shaped by a complex interaction of environmental, socio-economic, and institutional constraints, which collectively produce the paradox of high livestock dependency alongside declining productivity.

Climate Variability and Drought

A dominant challenge reported across Kiruhura, Nakaseke, and Kotido districts was increasing climate variability, particularly prolonged droughts and erratic rainfall. Respondents indicated that pasture availability has become highly seasonal and unpredictable, forcing pastoralists to travel longer distances in search of grazing land and water (Oke et al., 2025). This mobility often results in livestock weight loss, increased mortality, and conflicts over resources.

Land Fragmentation and Encroachment

The study found widespread fragmentation of communal grazing **land** due to population growth, private land ownership, and agricultural expansion. In Kiruhura and Nakaseke, expansion of crop farming and settlement areas has significantly reduced open grazing fields, leading to overgrazing in remaining communal lands.

Resource-Based Conflicts

Frequent conflicts between pastoralists and crop farmers were reported, especially in areas where livestock stray into cultivated fields (Panel, 2020). In Kotido, competition over scarce water points intensified tensions between neighboring communities, occasionally escalating into violent clashes.

Limited Access to Water and Veterinary Services

Respondents highlighted inadequate access to functional water sources during dry seasons and insufficient veterinary outreach services (Nations, 2019). This has contributed to increased disease outbreaks such as tick-borne diseases, reducing herd productivity.

Strategies Adopted by Livestock Farmers to Address Grazing Challenges

The study established that livestock farmers have developed a range of adaptive and coping strategies to mitigate grazing-related constraints, reflecting both traditional knowledge and emerging innovations.

Seasonal and Transhumant Mobility

Pastoralists in Kotido and parts of Nakaseke practice transhumance, moving livestock seasonally to areas with better pasture and water availability. This strategy helps sustain herds but increases exposure to conflicts and disease transmission.



(Source Primary field collection, 2026)

Fodder Conservation and Supplementation

In Kiruhura and Nakaseke, some Livestock farmers have adopted fodder conservation practices, including hay making and crop residue storage. However, adoption remains uneven due to limited technical knowledge and equipment.

Communal Resource Management

Communities reported the re-emergence of informal grazing agreements and communal resource-sharing arrangements, particularly around water points. These local institutions help reduce conflict and improve access to scarce resources.



(Source Primary field collection, 2026)

Diversification of Livelihoods

A significant number of households have diversified income sources by engaging in crop farming, petty trade, and charcoal production. This diversification reduces dependence on livestock alone but sometimes intensifies land-use pressure (Salve, 2025).

Adoption of Improved Breeds

The findings clearly indicated that, Some farmers have begun adopting improved and cross-bred cattle, which are more market-oriented but less drought-resistant, creating a trade-off between productivity and resilience.



(Source Primary field collection, 2026)

Table 4.1: Respondents' Views on Diversification of Cattle Breeds (n = 2,036)

Response Category	Frequency (n)	Percentage (%)	Interpretation
Strongly agree (crossbreeding improves productivity)	712	35.0%	High acceptance of improved breeds
Agree	586	28.8%	Positive but cautious adoption
Neutral	312	15.3%	Uncertain about benefits vs risks
Disagree (native breeds are more resilient)	298	14.6%	Preference for indigenous breeds
Strongly disagree	128	6.3%	Resistance to breed diversification

(Source Primary data, 2026)

The findings indicate that 63.8% of respondents support breed diversification, mainly due to improved milk yield and market value. However, a significant minority (20.9%) prefer indigenous breeds, citing drought resistance, low maintenance costs, and adaptability to harsh grazing conditions. This reflects the paradox between productivity-oriented livestock systems and resilience-based pastoral systems in Uganda's cattle corridor (Simpson, 2020).

Effectiveness of Policies and Institutional Frameworks Supporting Livestock Farming

The study revealed that while Uganda has several policies and institutional structures supporting livestock farming, their implementation effectiveness remains limited and uneven across districts.

Table 4.2: Perceptions of Policy and Institutional Interventions in Livestock Farming (n = 2,036)

Response Category	Frequency (n)	Percentage (%)	Interpretation
Strongly agree (policies improve livestock farming)	421	20.7%	Strong institutional confidence
Agree	612	30.1%	Moderate approval of policies
Neutral	388	19.1%	Limited awareness/uncertainty
Disagree	402	19.8%	Perceived weak implementation
Strongly disagree	213	10.5%	Institutional dissatisfaction

(Source Primary data, 2026)

The results show that only 50.8% of respondents view policy interventions positively, while 30.3% express dissatisfaction, citing weak extension services, poor funding, and limited field presence of veterinary officers. A notable proportion (19.1%) remained neutral, indicating low policy awareness and weak communication channels between institutions and farmers.

Although national policies such as the National Agricultural Policy and Livestock Development Strategy exist, many farmers reported low awareness of these frameworks. Implementation at district level was described as inconsistent due to inadequate funding and staffing (Panel, 2020).

Weak Extension Services

Agricultural extension services were found to be insufficient and irregular, limiting farmer access to modern livestock management practices. Farmers in Kotido reported the least contact with extension officers compared to Kiruhura.

Institutional Coordination Challenges

The study identified weak coordination between local governments, veterinary departments, and water management institutions, resulting in fragmented service delivery. This has reduced the effectiveness of integrated livestock support systems.

Positive Impact of Local By-Laws and Community Institutions

Despite national-level weaknesses, local governance structures and by-laws were found to play an important role in regulating grazing patterns, managing water access, and reducing conflicts. These informal institutions were particularly strong in pastoral communities (Simpson, 2020).

Limited Climate Adaptation Support

Institutional support for climate adaptation such as drought-resistant pasture development, water infrastructure, and early warning systems was found to be inadequate, contributing to continued vulnerability of livestock systems (Oke et al., 2025). The findings reveal a clear paradox: while livestock remains a critical source of livelihood, income, and cultural identity, its productivity is constrained by environmental stress, land pressure, and institutional weaknesses. Farmers are simultaneously adapting through mobility, diversification, and informal governance systems, yet these strategies are often insufficient to fully offset structural challenges.

Discussion

This study set out to understand the paradox of livestock farming in Uganda's cattle corridor by examining grazing constraints, adaptive strategies, and the effectiveness of policy and institutional frameworks (Panel, 2020). The findings reveal a structurally embedded tension between livestock productivity ambitions and ecological, institutional, and socio-economic realities, consistent with pastoral systems literature in semi-arid Africa.

Challenges Affecting Livestock Grazing Patterns

The study established that climate variability, land fragmentation, and resource conflicts are the most critical constraints shaping grazing systems. The increasing frequency of droughts has intensified pasture scarcity, forcing livestock mobility and reducing herd productivity (Panel, 2020). This finding aligns with broader scholarship on climate stress in pastoral systems, which emphasizes that rainfall unpredictability is a key driver of livelihood vulnerability in arid and semi-arid regions.

Land fragmentation observed in Kiruhura and Nakaseke reflects a long-term shift from communal grazing regimes to individualized land tenure systems. This transition has disrupted traditional rangeland management practices, leading to overgrazing in remaining communal pockets (Rubino et al., 2023). Similar patterns have been documented across East Africa, where privatization of land undermines mobility, a core adaptive strategy in pastoral systems.

Resource-based conflicts further illustrate the socio-political dimension of grazing constraints. Competition between crop farmers. The livestock keepers highlight the land-use paradox, where agricultural expansion improves food production but simultaneously reduces grazing space (Gregorini et al., 2022). The escalation of conflicts in Kotido underscores how environmental scarcity interacts with weak governance structures to produce localized insecurity.

Livestock Farmers' Adaptive Strategies

The findings show that livestock keepers are not passive victims but active agents employing a range of coping and adaptive strategies, including transhumance, fodder conservation, livelihood diversification, and breed selection (Environment, 2019).

Seasonal mobility remains the most important adaptation strategy, particularly in Kotido, confirming classical pastoral resilience theory that mobility is essential for managing spatially and temporally variable resources (Oke et al., 2025). However, the

effectiveness of mobility is increasingly constrained by land enclosure, administrative boundaries, and conflict risks, suggesting a declining flexibility of traditional pastoral systems.

Fodder conservation practices represent an emerging shift toward semi-intensive livestock production. Yet adoption remains uneven due to capital constraints and limited technical knowledge. This indicates a transition phase where traditional systems are gradually integrating modern practices but without full structural support.

Breed diversification presents a clear paradox. While improved breeds enhance milk and meat productivity, they are less resilient to drought and disease compared to indigenous breeds. This creates a productivity–resilience trade-off, a well-documented phenomenon in livestock systems under climate stress. Farmers’ preferences are therefore shaped by immediate survival needs rather than long-term productivity optimization (Panel, 2020).

Livelihood diversification reflects increasing economic pressure on pastoral households. While it enhances income stability, it also contributes to further land pressure through expanded crop cultivation, reinforcing the very resource scarcity it seeks to mitigate.

Policy and Institutional Frameworks

The study found that although Uganda has developed comprehensive livestock-related policies, their implementation effectiveness is constrained by institutional fragmentation, weak extension services, and limited farmer awareness.

The moderate level of policy approval (50.8%) indicates that while frameworks exist, they are not sufficiently translated into practical support at community level. This gap between policy design and implementation reflects a common governance challenge in decentralized agricultural systems, where local governments often lack adequate resources and technical capacity (Simpson, 2020).

Weak extension services were particularly pronounced in Kotido, suggesting spatial inequality in service delivery. This undermines technology transfer, disease control, and climate adaptation efforts, thereby perpetuating low productivity cycles.

Institutional coordination challenges further exacerbate inefficiencies. The lack of integration between veterinary services, water management authorities, and local governments results in fragmented responses to livestock challenges (Bonfoh et al., 2023). This finding supports institutional theory perspectives that emphasize coordination failure as a major constraint in multi-sectoral rural development systems.

However, the study also identified the importance of informal and community-based institutions, including by-laws and customary governance systems. These structures play a crucial role in regulating grazing access and managing conflicts, particularly where formal institutions are weak (Bank et al., 2018). This highlights the coexistence of formal and informal governance systems in shaping livestock outcomes.

Livestock Paradox in Uganda’s Cattle Corridor

The findings collectively illustrate a persistent paradox: livestock remains central to livelihoods, cultural identity, and rural economies, yet its productivity is undermined by environmental stress and institutional inefficiency.

On one hand, farmers are increasingly adopting modern practices such as improved breeds and fodder conservation, indicating a shift toward commercialization. On the other hand, structural constraints climate variability, land scarcity, and weak service delivery force continued reliance on traditional, risk-averse strategies such as mobility and indigenous breeds (Panel, 2020)

This duality reflects what can be described as a hybrid livestock system, where traditional and modern production logics coexist but do not fully integrate. The result is a system that is adaptive but not transformative, resilient but not highly productive.

Conclusion

This study examined the paradox of livestock farming in Uganda’s cattle corridor, with specific focus on grazing challenges, adaptive strategies adopted by farmers, and the effectiveness of policy and institutional frameworks. Drawing on empirical evidence from Kiruhura, Nakaseke, and Kotido districts, the study demonstrates that livestock farming remains a central livelihood system, yet it is increasingly constrained by environmental stress, land-use transformation, and institutional limitations.

The study concludes that livestock grazing patterns in Uganda are primarily shaped by climate variability, land fragmentation, and resource-based conflicts, which collectively reduce access to pasture and water. These constraints have intensified the vulnerability of pastoral and agro-pastoral households, forcing increased mobility and adaptive adjustments in production systems.

Despite these challenges, livestock farmers demonstrate considerable resilience through mobility strategies, fodder conservation, livelihood diversification, and selective breed adoption. However, these strategies are largely reactive rather than transformative, indicating that households are adapting to survival pressures rather than achieving long-term productivity gains.

The study further concludes that while Uganda has established policy and institutional frameworks to support livestock development, their effectiveness is constrained by weak implementation, limited extension service coverage, inadequate coordination among

institutions, and low policy awareness among farmers. Informal governance structures at community level partially compensate for these gaps, but they are insufficient to address structural constraints at scale.

Overall, the study identifies a persistent livestock paradox in Uganda's cattle corridor: a system where livestock remains economically and culturally vital, yet productivity and sustainability are undermined by ecological stress and governance inefficiencies. This paradox reflects a dual system in transition where traditional pastoral practices coexist with emerging commercialization efforts but without full institutional or ecological support.

The study therefore concludes that addressing the livestock paradox requires integrated interventions that strengthen climate resilience, improve institutional coordination, enhance extension services, and align livestock policies with the realities of mobile and risk-sensitive pastoral production systems.

Recommendation

Based on the findings and conclusions on the paradox of livestock farming in Uganda's cattle corridor, the study makes the following evidence-based recommendations:

Government of Uganda and development partners should prioritize investments in climate adaptation infrastructure, including water harvesting systems, valley dams, and protected watering points. In addition, the promotion of drought-resilient pasture species and fodder banks should be scaled up to reduce dependency on seasonal grazing. This will help stabilize livestock production under increasing climate variability.

The study recommends that Livestock breeding programs should adopt a balanced approach between productivity and resilience. While improved breeds should be promoted for commercial gains, indigenous breeds should be conserved and integrated into crossbreeding programs due to their adaptability to harsh environments. Extension services should educate farmers on appropriate breed selection based on ecological conditions.

The study further recommends that Ministry of Agriculture and local governments should expand its budget and adequately fund extension service delivery systems, particularly in hard-to-reach pastoral districts such as Kotido and Nakaeske district. Regular veterinary outreach programs should be enhanced to improve disease surveillance, vaccination coverage, and livestock health management.

It is more so recommended for improved coordination between district local governments, veterinary departments, water authorities, and land management institutions. A multi-sectoral livestock development framework should be strengthened to avoid fragmented service delivery. Policy implementation monitoring mechanisms should also be reinforced to ensure accountability and effectiveness.

The study recommends for the formal recognition and integration of customary institutions and community by-laws into district-level governance structures. These systems have proven effective in managing grazing access, reducing conflicts, and regulating resource use. Supporting them with legal and institutional backing will improve sustainability.

The study recommends the Government's efforts to strengthen livestock marketing systems, value addition, and agro-processing infrastructure. Establishing organized livestock markets and improving transport networks will enhance farmers' income and encourage commercialization of the livestock sector.

Nevertheless, the study recommends that while diversification in cattle farming in the Corridor there is a key coping strategy, it should be supported in a way that does not increase environmental degradation. Programs promoting alternative income sources such as dairy processing, beekeeping, and climate-smart agriculture should be expanded.

Lastly, the study recommends Livestock Farmers should be supported with timely Smart climate information services, training on sustainable grazing practices, and livestock management skills. Early warning systems for drought and disease outbreaks should be strengthened to improve preparedness and response.

Reference

- A.K, S., I. M. B. ., Bulime, E. W. N. ., Luwedde, J. ., Birabwa Aliro, E. ., Kajumba, M. M. ., Nattabi. (2023). *Identifying commodity-specific priority investments in selected districts of Uganda*. Food & Agriculture Org.
- Alizadeh, T. (2021). *Global Trends of Smart Cities: A Comparative Analysis of Geography, City Size, Governance, and Urban Planning*. Elsevier Science.
- Bank, A. D., Jica, Bank, W., & Ukaid. (2018). *The Web of Transport Corridors in South Asia*. World Bank Publications.
- Bhateja, V., Hoong, A. L. S., William, Y. G. S., & Omar, Z. (2026). *Smart Computing Paradigms: Human-Centric Systems for Sustainable Development: Proceedings of Seventh International Conference on Smart Computing and Informatics (SCI 2025)*, Volume 4. Springer Nature.
- Bonfoh, B., Kreppel, K. S., Nguyen-Viet, H., Fournié, G., & Wieland, B. (2023). *Enhancing livestock production and food safety through a one health approach in resource poor settings*. Frontiers Media SA.

- Change (IPCC), I. P. on C. (2022). *Climate Change and Land: IPCC Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial Ecosystems*. Cambridge University Press.
- Chatterjee, U., Ghosh, A., & Roy, S. K. (2025). *Eco-Resilience: Climate Change, Land Degradation and Sustainable Solutions*. Springer Nature.
- Environment, U. N. (2019). *Global Environment Outlook - GEO-6: Healthy Planet, Healthy People*. Cambridge University Press.
- Fletcher, A. J., & Reed, M. G. (2022). *Gender and the Social Dimensions of Climate Change: Rural and Resource Contexts of the Global North*. Taylor & Francis.
- Gregorini, P., Gordon, I. J., Kerven, C., & Provenza, F. (2022). *Grazing in Future Multi-scapes: From Thoughtscapes to Landscapes, Creating Health from the Ground Up*. Frontiers Media SA.
- Karikari, B., Tetteh, F., Kizito, F., Akinseye, F. M., Mutungi, C., Kotu, B. H., & Ansah, T. (2024). *Sustainable intensification of smallholder farming systems in Sub-Saharan Africa and South Asia*. Frontiers Media SA.
- Moritz, M., Samuels, I., Schareika, N., & Schlecht, E. (2026a). *Routledge Handbook of Pastoralism*. Taylor & Francis.
- Moritz, M., Samuels, I., Schareika, N., & Schlecht, E. (2026b). *Routledge Handbook of Pastoralism*. Taylor & Francis.
- Morrison, W. I., & Toye, P. (2026). *East Coast Fever: The Disease, its Impact and Control*. CABI.
- Nations, F. and A. O. of the U. (2019). *Special Report - The 2018 FAO/WFP agriculture and food security mission to Rakhine State, Myanmar: 19-Jul*. Food & Agriculture Org.
- Nations, F. and A. O. of the U. (2022). *Analysis of agriculture and rural development policy in Albania*. Food & Agriculture Org.
- Ndhlovu, E. (2026). *Agriculture and Sustainable Development in Sub-Saharan Africa: Resilience and Recovery Toward Sustainable Futures*. Springer Nature.
- Oke, O. E., Uyanga, V. A., Abioja, M. O., & Oretomiloye, F. (2025). *Climate-Smart Livestock Production: Strategies for Enhanced Sustainability and Resilience*. Frontiers Media SA.
- Olayide, O., Snyman, S., Muchangos, L. S. dos, & Kuch, A. (2026). *Accelerating the Circular Economy Transition: Innovations and Developments from Africa*. Frontiers Media SA.
- O'Mara, F. P., Wilkins, R. J., Mannetje, L. 't, Lovett, D. K., Rogers, P. A. M., & Boland, T. M. (2023). *XX International Grassland Conference: Offered papers*. BRILL.
- Oyanedel, J. C., Abs, D., & Rivera-Vargas, P. (2023). *Subjective Well-being in Online and Mixed Educational Settings*. Frontiers Media SA.
- Panel, M. M. (2020). *Meat, milk and more: Policy innovations to shepherd inclusive and sustainable livestock systems in Africa*. Intl Food Policy Res Inst.
- Patrick, N. (2021). *Handbook of Research on Mixed Methods Research in Information Science*. IGI Global.
- Poth, C. N. (2023). *The Sage Handbook of Mixed Methods Research Design*. SAGE Publications.
- Rathi, D. M. (2025). *Agricultural Economics-I*. Chyren Publication.
- Rubino, R., Sepe, L., Dimitriadou, A., & Gibon, A. (2023). *Livestock farming systems: Product quality based on local resources leading to improved sustainability*. BRILL.
- Salve, C. E.-B. A., Editor-Dr A. Sudarvizhi, Harry George, Anna George, Dr V. Anitha, Dr Bharati Verma, Sanjay Ambadas. (2025). *Multidisciplinary Research in Arts, Science & Commerce (Volume-25)*. The Hill Publication.
- Sharma, A., Rathi, V., Biswas, A., Singh, A., & Rana, O. (2026). *Multimodal Artificial Intelligence in Precision Agriculture: Practices, Challenges, and Applications*. CRC Press.
- Simpson, J. R. (2020). *Livestock Development in Subsaharan Africa: Constraints, Prospects, Policy*. Taylor & Francis Group.