



INITIATIVE ON
Livestock and Climate



Policy and institutions needed to transform livestock systems under climate change

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Photo: Camels drinking at a water pan in Wajir county in Kenya (photo credit: ILRI/George Wamwere-Njoroge).

“ This brief is a companion piece to the overall report “Livestock and Climate Change: Outlook for a more sustainable and equitable future”. The overall report and its associated briefs are legacy products of the CGIAR Livestock and Climate Initiative drawing from science generated during the 2022-2024 life of the research project.”

Key messages

- **Political will:** Governments must prioritize the livestock sector in national development plans, setting measurable sustainability goals and maintaining policy continuity across administrations.
- **Tailored financial solutions:** Support for smallholder farmers through microfinance and impact investment models is vital to overcoming barriers to adopting sustainable practices.
- **Strengthen extension services:** Investments in rural extension systems and technical assistance, particularly for youth, are crucial for scaling sustainable livestock practices.
- **Develop market integration:** Building strong value chains that connect producers to markets fosters economic resilience and promotes high-quality, sustainable products.
- **Foster collaborative innovation networks:** Coordinated efforts among research institutions, public and private sectors, and producer associations are necessary to standardize knowledge, support policymaking, and accelerate technology adoption.
- **Adopt participatory approaches:** Engaging local communities and diverse stakeholders ensures that policies and interventions are culturally appropriate and context-specific.



Photo: Lolkuniani livestock market. ILRI/Emmy Dortant

Introduction and problem statement

Despite global efforts to combat environmental degradation, the livestock sector remains a significant contributor to greenhouse gas (GHG) emissions, biodiversity loss, deforestation and ecosystem contamination (Alkemade et al. 2012; Grossi et al. 2019; Fuentes et al. 2019; Česonienė et al. 2019; Mora et al. 2017). While international frameworks such as the Paris Agreement, Sustainable Development Goals and national strategies like Nationally Determined Contributions, National Biodiversity Strategies and Action Plans, National Adaptation Plans and Nationally Appropriate Mitigation Actions aim to address these issues, the adoption of sustainable practices and technologies in the agriculture and livestock sectors has been slow.

Though well-intentioned, current policies often lack specific indicators and fail to create the conditions for large-scale implementation of sustainable solutions. Macro-level factors such as weak political will, fragmented stakeholder coordination and inconsistent policy continuity impede the development of effective frameworks tailored to the unique needs of each nation. A more cohesive and targeted approach is needed to address these challenges, emphasizing political commitment, multi-sector collaboration and investments in scalable technologies. Sustainable transformation in the livestock sector is critical to reducing GHG emissions and advancing global environmental goals.

Against this background and based on research conducted under the CGIAR Livestock and Climate Initiative, this brief provides a comprehensive overview of what an enabling environment might look like to transform livestock systems under climate change and how policy analysis could contribute to its development.

Creating an enabling environment to transform livestock systems under climate change

Public policies progress through stages, from problem identification to evaluation, influenced by macro-level factors such as political will, stakeholder coordination and programme continuity (Koch 2004; Leeuwis et al. 2021; Clapp 2021). National Development Plans emphasize the urgency of addressing resource depletion, GHG emissions and deforestation, serving as foundational frameworks for sustainability initiatives. In this regard, our research highlights Costa Rica as a country with strong political will, transforming it into a global leader in carbon neutrality (Moreno Lerma et al. 2022).

Political will is vital for long-term sustainability. This is demonstrated through multi-sector initiatives and investment in scalable technologies. Effective coordination among public, private and academic sectors is essential for achieving shared goals in livestock. Our research identifies The Roundtable for Sustainable Cattle (MGS-Col) in Colombia and the Argentine Sustainable Beef Board as notable examples of diverse stakeholder collaboration. A significant milestone for Colombia was the launch of the National Public Policy on Sustainable Cattle 2022–2050, developed through a multi-year process with MGS-Col members (Díaz Baca et al. 2024a; Sandoval et al. 2023a).

Regarding programme continuity, our research highlights that Costa Rica has consistently pursued its carbon neutrality goal across administrations, supported by initiatives like the Cattle Nationally Appropriate Mitigation Actions. Argentina has made some progress in aligning policies, while Colombia previously lacked a cohesive public policy, leading to fragmented efforts. The National Public Policy on Sustainable Cattle 2022–2050 aims to address this gap (Díaz Baca et al. 2024a; Sandoval et al. 2023a).

These macro-level factors intersect with producers' perceptions of public policies. When promoting new practices or technologies, it is crucial to highlight both advantages and potential drawbacks, as awareness of disadvantages can deter stakeholders from adoption (Kok and Klerkx 2023). Challenges such as unfamiliarity with new strategies, high initial investments and resistance due to risk aversion and adherence to traditional practices often hinder a transition to sustainable methods. These micro-level factors vary in intensity depending on geographic and cultural contexts but commonly include difficulties in securing financing and inadequate training for transitioning to new practices, prompting stakeholders to perpetuate conventional methods, as also shown in our research from Colombia (Mejía et al. 2024; Díaz Baca et al. 2024b; Triana Ángel et al. 2024; Ramos et al. 2024; Lienert and Burkart 2023; Triana Ángel and Sánchez Castillo 2023).

In the following sections, we describe some important elements of an enabling environment to transform livestock systems under climate change.

Sustainable and climate finance

Climate finance is crucial in combating climate change, encompassing various financial mechanisms to support mitigation and adaptation efforts. It involves contributions from the public and private sectors alongside international funding initiatives at multiple levels. Key components include the Green Climate Fund and mechanisms under the United Nations Framework Convention on Climate Change, which channeled funds to developing countries for climate projects. National climate finance strategies help mobilize domestic resources and align financial incentives with climate goals.

Colombia's introduction of a special credit line in 2021 to promote sustainable agricultural practices, like silvo-pastoral systems, illustrates national strategies in action. However, as our research shows, uptake among livestock farmers has been low despite favourable conditions, with only 230 out of 163,443 credits allocated to sustainable practices from 2021 to 2023 (Sandoval et al. 2024). Our research also revealed that the Colombian livestock credit system is disproportionately skewed toward a small number of large-scale producers, making it difficult for the many smallholders—who are crucial to climate change mitigation—to access funding (Mejía et al. 2024).

Tailored finance mechanisms for smallholder livestock farmers are essential to overcome adoption barriers. Traditional lending models often exclude these farmers due to collateral requirements and high transaction costs regions (Rietveld and van der Burg 2021). Sustainable finance models, including microfinance and impact investment funds, can bridge this gap by providing credit and supporting capacity building and market linkages.

Collaborative efforts among financial institutions, development agencies, research bodies and grassroots organizations are necessary for designing context-specific finance solutions. A holistic approach integrating financial, environmental and social sustainability is key to resilient agricultural systems and inclusive rural development.

A notable success was the establishment of a sustainable beef value chain in Colombia, developed through collaboration among scientists at the International Center for Tropical Agriculture (CIAT), the German NGO Climate Focus and the Colombian NGO GANSO. This initiative combines technical support for sustainable cattle management with a sustainability label (Aval GANSO), access to sustainable credit and a differentiated market for sustainable beef. By 2023, 41,209 hectares were certified under this label, with certified beef available in 190 supermarkets across 33 cities. The GANSO co-investment model significantly increased daily live-weight gains, animal stocking rates and beef yields, demonstrating the model's economic and environmental viability. Our research shows that this endeavour serves as a benchmark for collaboration between agribusiness, researchers and NGOs in Latin America (Gutiérrez et al. 2023a, 2023b; Moreno Lerma et al. 2023; Burkart et al. 2022).

Rural extension and technical assistance

In developing countries, underdeveloped or nonexistent extension systems limit the knowledge transfer necessary for adopting sustainable production practices. While local technical assistance from input suppliers, NGOs and development projects can help, they often struggle to scale proven technologies. The involvement of diverse actors can result in outdated or contradictory information, restricted access to knowledge, and short-term support that lacks a long-term vision, hindering the adoption of sustainable livestock practices.

Our research in Colombia identified significant barriers to sustainable livestock production, emphasizing the need for stronger extension and technical assistance systems. Establishing educational programmes focused on sustainable management for rural youth is essential for immediate knowledge transfer and long-term technical support in key livestock regions (Sandoval et al. 2024). Notable examples from Colombia include a public-private partnership involving a major dairy company, CIAT researchers and the National Learning Service to develop vocational training in sustainable livestock farming (Triana Ángel and Burkart, 2023) and the GANSO technical assistance model described above (Gutiérrez et al. 2023a, 2023b).

Creating innovation networks among research institutes, universities, extension services, producer associations and the private sector can help standardize knowledge and improve the efficiency of extension services, leading to quicker technology adoption. Connecting sustainable finance with knowledge systems, such as technical assistance and extension services, can also address key barriers to adoption. The Aval GANSO initiative in Colombia exemplifies this approach (Gutiérrez et al. 2023a, 2023b; Moreno Lerma et al. 2023; Burkart et al. 2022; Burkart et al. 2021).

For long-term investments like silvo-pastoral systems, integrating finance and technical assistance is crucial, especially given the high risks of technology adoption failure without adequate support. Our research shows that policies should strengthen and prioritize livestock value chains within national or regional agricultural extension and development plans (Enciso et al. 2021). Historically, rural extension efforts have focused on crops, so there is a need to shift to integrating livestock-related climate change adaptation and mitigation strategies. Extension strategies should engage producers through holistic campaigns, promote social learning and problem-solving and apply participatory approaches and information and communication technologies.



Market and value chain development and integration

Market development and value chains are crucial for enhancing adaptive capacity, promoting sustainable intensification and ensuring economic viability in livestock farming. Market-oriented strategies involve adopting climate-smart practices, sustainable land management, resilient livestock breeds, and improving market access and infrastructure, all of which are aimed at increasing productivity and profitability while reducing environmental impacts.

Transforming livestock systems requires building strong value chains that connect producers to markets to facilitate an efficient flow of goods and services. Value chain development focuses on improving production efficiency, enhancing processing, promoting quality standards, investing in infrastructure and fostering partnerships. These efforts improve production and enhance resilience by diversifying income sources and providing access to financial services and insurance, enabling farmers to adapt to climate variability and seize new market opportunities.

Forage seed systems exemplify input market development. They are often underdeveloped, restricting access to essential technologies for sustainable livestock farming. Our research indicates that removing policy and institutional barriers, such as complex variety registration processes, is vital and could incentivize private sector investments in the forage seed sector, lowering seed costs for farmers and increasing seed access (Flórez et al. 2024; Junca Paredes et al. 2023). On the output side, focusing on high-quality and sustainable products can lead to differentiation and price premiums, as demonstrated by the Aval GANSO initiative in Colombia (Gutiérrez et al. 2023a, 2023b; Moreno Lerma et al. 2023).

Additionally, digital innovations in agribusiness, blockchain technology for supply chain transparency and market-based incentives for ecosystem services offer promising opportunities to improve the efficiency and sustainability of livestock value chains, enhance climate resilience and contribute to global climate goals. Our research shows that strong economic gains can be obtained from sustainable intensification of forage-based livestock systems if payments for ecosystem services are in place (Gonzalez Quintero et al. 2024; Sandoval et al. 2023b).

Research and development

Research and Development (R&D) is essential for transforming livestock systems to adapt to and mitigate climate change by promoting climate-smart practices and technologies. Key efforts include enhancing livestock productivity through genetic improvements for heat tolerance and disease resistance and innovative feeding strategies to boost feed efficiency and minimize environmental impacts. R&D also supports sustainable land management practices like rotational grazing and integrated crop-livestock systems to enhance soil health and biodiversity. Additionally, advancements in animal health, including vaccines and diagnostic tools, protect livestock from climate-induced diseases.

Ideally, R&D fosters agricultural innovation systems that integrate actors from science, business, civil society and government to drive technological, social and institutional innovations needed for future food systems (Klerkx and Begemann, 2020). Our research on innovation systems for forages and livestock in Colombia reveals that, despite collaboration among key actors, the lack of a common strategy leads to duplicated efforts, inefficient funding allocation and unclear roles, resulting in an overall deficient system (Enciso et al. 2021). The MGS-Col initiative is addressing these challenges by bringing together approximately 70 national and international stakeholders from the livestock sector to facilitate policy development, rural extension and information exchange, aiming to standardize institutional efforts (Díaz Baca et al. 2024; Sandoval et al. 2023a).

The importance of understanding local disparities, contexts and preferences for tailored policy and scaling strategies

Understanding local disparities, contexts and preferences is crucial for developing tailored policies and scaling strategies in livestock systems, especially when addressing climate change and socioeconomic challenges. Achieving meaningful local impact is challenging when transforming food systems. Candel and Biesbroek (2016) emphasize that effective local-scale integrative policies must clearly define the problem, engage relevant stakeholders across governance levels, identify key transformation elements and provide multiple pathways for solutions. Edwards et al. (2019) stress the value of transdisciplinary and multisectoral approaches that focus on previously identified issues, helping to adapt global solutions to local contexts effectively.

Livestock systems vary significantly due to local factors such as geography, climate, culture, economy and resource availability. Policymakers must understand this diversity to create context-specific interventions. Local disparities in resources and infrastructure affect policy feasibility and impact; for example, regions with limited water may benefit from drought-resistant forage crops, while areas with high disease rates may require improved veterinary services.

Cultural norms also influence the acceptance of new technologies; thus, policies aligned with local preferences are more likely to succeed. Engaging local communities helps ensure interventions are culturally appropriate and inclusive. Our research shows that local contexts are vital for scaling innovations, as strategies effective in one region may not work in another (Lienert and Burkart 2023; Triana and Burkart 2023). A nuanced, context-adaptive approach fosters broader impact and sustainability.

Participatory methods in policy development are essential for capturing local knowledge. Involving stakeholders like farmers, community leaders and local institutions promotes ownership and relevance, improving the chances of successful implementation. The National Public Policy on Sustainable Cattle 2022–2050 in Colombia, developed by MGS-Col with over 40 public and private institutions, illustrates participatory governance. Key lessons from our research highlight the importance of involving diverse actors, creating regional dialogue spaces to adapt guidelines to community needs and fostering trust among institutions for effective local policy implementation (Díaz Baca et al. 2024a; Sandoval et al. 2023a).

Recommendations

From the examples described, we offer the following policy recommendations:

- 1. Enhance political will.** Governments can demonstrate commitment by prioritizing the livestock sector in national development plans and establishing clear, measurable sustainability goals with clear implementation plans.
- 2. Governments can support the development of tailored financial solutions** specifically designed to help smallholder livestock farmers adopt sustainable practices such as microfinance and impact investment.
- 3. Strengthen extension services.** Governments can invest in rural extension and technical assistance systems to facilitate knowledge transfer and long-term support for sustainable livestock practices, especially targeting youth.
- 4. Promote market integration.** Developing value chains that connect producers to markets could be encouraged, enhancing access to sustainable inputs and supporting differentiated, high-quality products.
- 5. Foster innovation networks.** Public sector support is essential for collaborative networks among research institutions, the public and private sectors and producer associations to standardize knowledge, support policymaking and accelerate technology adoption in livestock systems.
- 6. Implement participatory approaches.** Governments can engage local communities and diverse stakeholders in policy development to ensure interventions are culturally appropriate and context-specific.
- 7. Encourage research and development.** Governments can invest in R&D initiatives focused on climate-smart practices, innovative feeding strategies, and advancements in animal health to enhance the resilience of livestock systems.
- 8. Strong institutions** are crucial for enforcing regulations, providing technical support and facilitating access to finance. Effective governance is key to ensuring accountability and inclusiveness in decision-making while evaluating existing interventions and identifying best practices that enhance livestock productivity, environmental sustainability and socioeconomic outcomes.
- 9. Policy and institutional analysis** are essential for understanding the current landscape of livestock systems, identifying gaps and developing effective climate-resilient strategies and can be prioritized in research endeavours, public investments and development projects.

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