



Food and Agriculture
Organization of the
United Nations



Boosting Koronivia in the livestock sector

Workshop report

BOOSTING KORONIVIA

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Required citation:

Uwizeye, A., Reppin, S., Opio, C., Teno, G., Lopes, J., Dondini, M. and Langston Diagne, M. 2021. *Boosting Koronivia in the livestock sector – Workshop report*. Rome, FAO. <https://doi.org/10.4060/cb4348en>

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ISBN 978-92-5-134276-3

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Abbreviations and acronyms

AEZ	Agro-ecological Zone
AFOLU	Agriculture, Forestry and Other Land Use
AMR	Antimicrobial resistance
ASF	Animal-sourced food
BAU	business-as-usual
CBPP	Contagious bovine pleuropneumonia
CCAC	Climate and Clean Air Coalition
COP	Conference of Parties
CSA	Climate-Smart Agriculture
EF	Emission Factor
ETF	Enhanced Transparency Framework
FMD	Foot-and-mouth disease
GCF	Green Climate Fund
GEF	Global Environment Fund
GHG	Greenhouse Gas
GRA	Global Research alliance
GWP	Global warming potential
IFAD	International Fund for Agriculture Development
IGAD	Intergovernmental Authority on Development
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
KJWA	Koronivia Joint Work on Agriculture
LDC	Least developed countries
LUC	Land use change
MRV	Measurement, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Plan
NAPA	National Adaptation Programmes of Action
NAP-GSP	National Adaptation Plan Global Support Programme
NDCs	Nationally Determined Contributions
NEDI	North Eastern Development Initiative

PPR	Peste des petits ruminants
SBI	Subsidiary Body for Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SDGS	Sustainable Development Goals
SLCP	Short-Lived Climate Pollutant
SOC	Soil Organic Carbon
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

Acknowledgements

This document represents the report of the workshop series on “Boosting Koronivia in the livestock sector” conducted online in the four regions of Eastern Africa, Western Africa, Southern Africa and Latin America and the Caribbean from 30 September until 21 October 2020. These workshops were organized by the FAO’s Animal Production and Health Division (NSA) and the Office of Climate Change, Biodiversity and Environment (OCB) under the overall guidance of Henning Steinfeld (NSAL). This report was prepared by Aimable Uwizeye (NSAL) and Saskia Reppin (NSAL) with the contributions from Carolyn Opio (FAOSLM), Gabriel Teno (NSAL), Juliana Lopes (NSAL/OCB), Marta Dondini (NSAL), and Mohamed Langston Diagne (OCB).

Numerous colleagues from the Animal Production and Health Division (NSA), Office of Climate Change, Biodiversity and Environment (OCB) and Regional Offices facilitated and moderated the workshops including Andrés Gonzales Serrano (RLC), Berhanu Bedane (FAOSFS), Etienne Drieux (OCB), Eva Bravo (FAOSLM), Felipe Chamizo (FAORLC), Lionel Gbaguidi (FAOSFW), Mame Diene (FAOSN), Martial Bernoux (OCB), Pablo Valencia (FAORLC), Ricarda Mondry (FAOSFE), Tanja Lieuw (FAORLC), Timothy Robinson (NSAL) and Ugo PicaCiamarra (NSAL).

Much gratitude goes to the FAO Regional Office for Latin America and the Caribbean (RLC) and the Subregional Offices for Mesoamerica (SLM), Eastern Africa (SFE), Western Africa (SFW) and Southern Africa (SFS) and FAO country representations of invited countries. The organizers thank Julio Berdegú, Assistant-Director General and Regional representative for Latin America and the Caribbean (RLC) and Subregional Coordinators: Chimimba David Phiri (SFE), Patrice Talla Takoukam (SFS), Gouantoueu Robert Guei (SFW) and Adoniram Sanches Peraci (SLM).

The organizers are grateful for the active engagement of the numerous participants who represented their countries and shared their experience and knowledge during the workshops.

Support for editing, communication and publication of the report came from Fiona Bottigliero (OCB), Alina Gerke (OCB) and Claudia Ciarlantini (NSAL). Lucia Moro (OCB) and Clara Proença (OCB) managed graphic design. Administration support was provided by Christine Ellefson (NSAL) and Catherine Gaury (NSA).

The organisation of the workshops was supported by the project (GCP/GLO/998/GER): ‘Supporting the Implementation of the Koronivia Joint Work on Agriculture Roadmap (Boosting Koronivia)’ funded by the Federal Ministry of Food and Agriculture (BMEL) of the Federal Republic of Germany.

Executive summary

The adoption of the Paris Agreement in 2015 paved the way for countries to commit to the international response to climate change through the transition to a low-emission economy and the development of a climate-resilient future. In 2017, the 23rd Conference of Parties (COP23) adopted the Koronivia Joint Work on Agriculture (KJWA) to discuss the role of agriculture in climate action while considering the vulnerability of the sector to climate change and addressing food security. The KJWA can play a crucial role in enabling the livestock sector to contribute to climate action by mobilizing knowledge, technology, finance, and capacity development.

The livestock sector is an important topic of the KJWA because it contributes significantly to food security and the livelihoods of hundreds of millions of people across the world. It provides high-quality, nutritious animal-source foods and is a major source of income for those involved. Climate change impacts the livestock sector significantly through long and severe droughts, floods or wildfires leading to high mortality of animals, disease outbreaks and low productivity. Livestock also have environmental externalities including the emission of anthropogenic greenhouse gases (GHG), nutrient pollution, water use and land degradation.

From 30 September to 22 October 2020, the Food and Agriculture Organization of the United Nations (FAO) Animal Production and Health Division (NSA) and the Office of Climate Change, Biodiversity and Environment (OCB), in collaboration with the FAO Regional Office for Latin America and the Caribbean (RLC), and Subregional Offices for Mesoamerica (SLM), Eastern Africa (SFE), West Africa (SFW) and Southern Africa (SFS) organized a series of workshops on “Boosting Koronivia in the livestock sector”.

The series of regional workshops provided a space for countries to exchange experiences and discuss how the KJWA can support climate actions on livestock while delivering the 2030 Agenda for Sustainable Development.

Participants identified several practices that contribute to the mitigation of GHG emissions and enhance adaptation and resilience of the livestock sector to climate change thereby ensuring food security. They exchanged views and experiences on opportunities for livestock systems in national climate actions, and shared examples of national initiatives and policies.

Across all regions, the major challenges identified were as follows:

- ▶ limited capacity to conduct GHG emission inventories including the application of Measurement, Reporting and Verification (MRV) tools and methodologies;
- ▶ financial constraints including limited access to external funds, limited investment in the livestock sector, and inadequate national budget allocations;
- ▶ limited synergies between authorities and institutions on livestock and environmental issues as well as political will were highlighted by most countries;
- ▶ the need to raise awareness among farmers and livestock stakeholders on the links between livestock and climate change.

For the Eastern and Western Africa regions, pastoral systems pose a particular challenge related to land use management and vulnerability to recurring climate crises.

In Latin America and the Caribbean, participants highlighted the challenge in quantifying soil organic carbon to demonstrate offsets potential in grassland and silvo-pastoral systems.

Key actions to improve livestock systems identified across all regions include:

- ▶ enhancing technical and institutional capacities;
- ▶ raising awareness and developing coherent policies;
- ▶ improving governance of land and livestock systems;
- ▶ investing in research that can be scaled up at regional level;
- ▶ transferring technology and innovation to smallholder producers;
- ▶ accessing climate finance and creating incentives for farmers.

Livestock-specific policies need to be based on evidence and economic analysis to strengthen synergies and reduce trade-offs with other sustainable development objectives. A holistic approach, therefore, is required to account for GHG sources and sinks in livestock systems. Furthermore, mitigation and adaptation actions will need to go hand-in-hand to create resilient livestock systems and ensure food security.

In line with the Koronivia roadmap, the outcomes of this workshop have been presented during the United Nations Framework Convention on Climate Change (UNFCCC) Koronivia dialogues from 24th to 25th November 2020.

The workshops were organized in the context of the project (GCP/GLO/998/GER): ‘Supporting the implementation of the Koronivia Joint Work on Agriculture roadmap (Boosting Koronivia)’, funded by the Federal Ministry of Food and Agriculture (BMEL) of the Federal Republic of Germany. The project aims to strengthen national capacities to identify strategies and mechanisms to adopt best practice, innovation and technologies that increase resilience and sustainable production in livestock systems according to national circumstances.

1. Background and purpose

Since the adoption of the Paris Agreement in 2015, countries have committed to make their contribution in the international response to climate change, mainly through the transition to a low-emission economy and the development of a climate-resilient future. Parties are required to set and submit their economy-wide or sector-specific GHG emission reduction and adaptation targets, through their Nationally Determined Contributions (NDCs). Of the 197 Parties to the United Nations Framework Convention on Climate Change (UNFCCC) more than 80 countries have considered livestock in their NDCs either for adaptation or mitigation measures.

During the 23rd Conference of Parties (COP23) in 2017, climate negotiations in Bonn adopted the Koronivia Joint Work on Agriculture (KJWA) (Decision 4/CP.23) (UNFCCC, 2018). This decision requested the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI) to jointly address issues related to agriculture through consultation with Parties and observers, taking into consideration the vulnerabilities of agriculture to climate change and approaches to addressing food security. It was the first substantive outcome and COP decision in the history of the Conventions agenda on agriculture.

The KJWA can play a crucial role in enabling the livestock sector to contribute to climate action by mobilizing knowledge, technology, finance and capacity. It acknowledges the strategic importance of livestock including key areas such as improved soil carbon sequestration in grazed grasslands, improved nutrient use and manure management and improved livestock management systems.

Five of the six KJWA topics are related to the livestock sector:

- ▶ 2(b) Methods and approaches for assessing adaptation, adaptation co-benefits and resilience;
- ▶ 2(c) Improved soil carbon, soil health and soil fertility under grassland and cropland as well as integrated systems, including water management;
- ▶ 2(d) Improved nutrient use and manure management towards sustainable and resilient agricultural systems;
- ▶ 2(e) Improved livestock management systems including agro-pastoral production systems and others; and
- ▶ 2(f) Socioeconomic and food security dimensions of climate change in the agricultural sector.

The ongoing KJWA process offers good opportunities for countries to exchange views and experiences related to the inclusion of livestock in their national climate actions.

Livestock are key drivers for sustainable development in agriculture. They contribute to food security, nutrition, poverty alleviation, and economic growth. Through the adoption of best practices, the sector can reduce its environmental impacts and become more efficient in the use of resources. As part of achieving the 2030 Agenda for Sustainable Development and the Paris Agreement, FAO is committed to assisting countries to achieve food security while tackling climate change through improved livestock systems management.



2. Workshop objectives and structure

The objectives of the online workshops were to:

- ▶ discuss the opportunities for livestock systems to be considered in national climate action, whilst at the same time enhancing livestock's contribution to food and nutrition security, resilience and livelihoods; and
- ▶ exchange ideas and experiences on the best use of the KJWA outputs and roadmap to assist countries in including livestock targets in the national plans and actions.

For each region, the workshop was held in two sessions of 2.5 hours each day and divided into five main sessions:

1. Official opening.
2. Keynote presentation on the introduction of the KJWA.
3. Presentations: Overview and outlook of regional livestock sectors; summary of the submissions of Parties and observers to the UNFCCC on topic 2 (e) on improved livestock management systems including agro-pastoral systems and others; options for reducing enteric methane in ruminants systems and climate finance analysis of livestock Green Climate Fund (GCF) and Global Environment Facility (GEF) funded projects.
4. 1st group discussion focused on exchanging views and experiences on the contributions of livestock to climate action, and discussing the role of KJWA and key actions towards improving livestock systems.
5. 2nd group discussion focused on how to enhance carbon sequestration, identifying challenges and barriers to implement climate action in the livestock sector and identifying data and research needs of the livestock sector.
6. Reporting of breakout discussion groups in plenary and general discussion.

See [annex 1](#) for workshop agenda and [annex 2](#) for information package shared with participants ahead of the meeting.

3. Workshop participants

Over 90 government officials from 35 countries and 48 FAO colleagues from headquarters and decentralised offices joined this series of workshops in total (**table 1**). The workshop brought together government officers from the Ministries in charge of Livestock and the Ministry of Environment as well as FAO colleagues. The full list of participants is in **annex 3**. At least 33 percent¹ of the workshop participants confirmed their involvement in the Koronivia process for their respective countries. Those participants either directly represent their respective countries in climate negotiations at UNFCCC or are advisors on matters of livestock and climate change (GHG inventories, livestock development, and sector planning).

Table 1. Workshop regions, dates, countries and participants

Region	Dates 2020	Participants (m/f)	FAO colleagues ² (m/f)	Countries participated ³
Eastern Africa	30 Sept – 1 Oct	14 (10/4)	13 (7/6)	Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan (6)
Latin America and the Caribbean	6 – 7 Oct	35 (18/17)	20 (10/11)	Argentina, Brazil, Chile, Costa Rica, Dominican Republic, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay (11)
Western Africa (francophone)	14 – 15 Oct	28 (21/7)	19 (13/6)	Benin, Burkina Faso, Burundi, Cameroon, Côte d'Ivoire, Djibouti, Guinea, Mali, Niger, Senegal (10)
Southern Africa	20 – 21 Oct	18 (10/8)	12 (8/3)	Botswana, Eswatini, Lesotho, Madagascar, Malawi, Mozambique, South Africa, Zambia (8)

The workshops included interactive poll questions, aiming to explore the participants' experience regarding Koronivia topics and process, and access to climate finance. See summary results in the **appendix 4**.

¹ Estimate based on in-workshop polls, excluding Latin America and the Caribbean.

² Including organizing team (moderators, host and facilitators).

³ The following countries were invited to participate: Eastern Africa (Eritrea, Ethiopia, Somalia, South Sudan, Kenya, Uganda, Rwanda); Latin America and the Caribbean (Argentina, Brazil, Chile, Colombia, Cuba, Ecuador, Mexico, Paraguay, Peru, Uruguay, Guatemala, Panama, Nicaragua, Costa Rica, Honduras, El Salvador); Western Africa (francophone) (Benin, Burkina Faso, Burundi, Cameroon, Chad, Côte d'Ivoire, Djibouti, Guinea, Mali, Mauritania, Niger, Senegal, Togo); and Southern Africa (Angola, Botswana, Comoros, Eswatini, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Tanzania, Zambia, Zimbabwe).

4. Summary of workshop presentations

4.1 FAO and the Koronivia Joint Work on Agriculture (KJWA)

Presentations by Martial Bernoux, FAO (Eastern Africa), Mohamed Langston Diagne, FAO (Southern and Western Africa) and Tanja Liew, FAO (Latin America and Caribbean).

The landmark decision of the 23rd Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) (Decision 4/CP.23) on the Koronivia Joint Work on Agriculture (KJWA) requests the two Subsidiary Bodies under the Convention, namely the Subsidiary Body for Scientific and Technological Advice (SBSTA) and the Subsidiary Body for Implementation (SBI), to jointly address issues related to agriculture, taking into consideration the vulnerabilities of agriculture to climate change and approaches to addressing food security. The KJWA process included the organisations of workshops and meetings that are attended by constituted bodies, Parties to the convention, observers and stakeholders and the financial mechanism and climate finance funds, such as Green Climate Fund (GCF), Global Environment Facility (GEF), Adaptation Fund (AF), Least Developed Countries Fund (LDCF) and Special Climate Change Fund (SCCF) (UNFCCC, 2021a).

The decision 4/CP.23 instituted a Koronivia roadmap with a schedule of in-session workshops on six themes aimed at advancing exchanges among Parties on agriculture-related issues (Drieux *et al.*, 2019):

- Modalities for implementation of the outcomes of the five in-session workshops on issues related to agriculture and other future topics that may arise from this work;
- Methods and approaches for assessing adaptation, adaptation co-benefits and resilience;
- Improved soil carbon, soil health and soil fertility under grassland and cropland as well as integrated systems, including water management;
- Improved nutrient use and manure management towards sustainable and resilient agricultural systems;
- Improved livestock management systems including agro-pastoral production systems and others;
- Socioeconomic and food security dimensions of climate change in the agricultural sector.

An intersessional workshop was also adopted (in June 2019 during SB50) to address sustainable land and water management and strategies and modalities for scaling up implementation (to be held in 2021). Four of the six initial themes have been addressed during in-session workshops (UNFCCC, 2021b). The COVID-19 pandemic has interrupted the organization of the Koronivia workshop and COP26. The workshop on topic 2(e) Management of Livestock Systems had been postponed to 24–25 November 2020 (UNFCCC, 2021c) and the one on topic 2(f) Socio-economic and Food Security Dimensions to 1–2 December 2020 (UNFCCC, 2021d). Both workshops were held virtually.

FAO works closely with the UNFCCC at the regional and international level. The “Boosting Koronivia” project marks the ongoing realization of FAO’s support to the KJWA through the development of knowledge products and facilitating exchange of information between countries. These knowledge products can take the form of publications and documents such as analyses of submissions, workshop summaries, reports and case studies (FAO, 2021a). FAO supports agricultural experts to prepare their submissions and informally share their views through the organization of dialogues, webinars and technical workshops such as this one on the livestock sector. At the international level, FAO in conjunction with its regional offices supports several regional knowledge platforms and networks. In Latin America the PLACA (Plataforma de Acción Climática en Agricultura), in Southeast Asia the ASEAN Climate Resilience Network, in the Middle East the League of Arab States, and in Africa the AGNES (African Group of Negotiators Expert Support) network.

4.2 Improvement of livestock management systems, topic 2(e)

Presentation by Aimable Uwizye, FAO.

The livestock sector contributes highly to the livelihoods of millions of rural farms and produces high-quality nutritious animal-source foods. For most rural farmers, livestock are the main sources of financial incomes. The sector, however, is affected by climate change across different agro-ecological zones, through a significant rise in global mean temperature, changes in precipitation patterns and intense extreme weather events (e.g. cyclones or long drought). The livestock sector has some externalities including its contribution to climate change by releasing GHG emissions into the atmosphere such as the short-lived methane, nitrous oxide and carbon dioxide. Despite these challenges, livestock are flexible and offer an opportunity for mitigation and adaptation actions. This situation emphasizes the urgency to design net-zero emission livestock systems.

With regards to the KJWA topic 2(e) on improved livestock management systems including agro-pastoral systems, Parties and observers to the UNFCCC have submitted their views in preparation of the Koronivia workshops on the same topic. The detailed list of Parties and observers' submissions reviewed is provided in **Table 2**.

Regarding Parties' submissions, most of them focused on climate-smart solutions that can enhance the efficiency of natural resources use and animals while reducing GHG emissions. These solutions were articulated around the need to develop integrated and low-emission livestock systems while ensuring zero deforestation, limiting land expansion, and restoring degraded grasslands. The latter is in line with the UN decade on Ecosystem Restoration. Furthermore, Parties mentioned the need to disseminate innovative technologies in developing countries and to empower consumers. The submissions also highlighted the need for evidence-based policies and access to finance for farmers and other stakeholders along the livestock supply chain. Such policies can support the adoption of best practices and improve farmers' access to public subsidies and other financial incentives.

Regarding the Measurement, Reporting and Verification (MRV) framework, Parties called for the improvement of methods for GHG emissions accounting based on the internationally agreed guidelines such as the FAO Livestock Environmental Assessment and Performance (LEAP) Partnership (FAO, 2021b) and the development of country-specific emission factors for methane. In summary, Parties suggested that the forthcoming Koronivia workshop should discuss the identification of an enabling environment and appropriate policies, which can encourage the adoption of sustainable livestock management practices. Furthermore, discussions should also focus on interventions to increase livestock profitability while promoting healthy diets and decent livelihoods.

Regarding submissions by observers and other organisations, they advocated for the adoption of mitigation options that promote sustainable and low-carbon livestock systems while improving land use and energy efficiency. Other measures include the development of efficient early warning systems in arid and semi-arid regions and tools, technology and capacity building for all stakeholders. They mentioned that, in several countries, policies could focus on subsidies for smallholder livestock farmers, adoption of innovative technology at low-cost, and zero-deforestation. Furthermore, they called for the enhancement of transparency along food chains in monitoring progress to low-emission livestock agri-food systems. They also mentioned the need for inclusive livestock systems by considering the voice of women, youth and indigenous communities. Observers also called for the involvement of farmers in policy and decision-making processes mainly through multi-stakeholder initiatives such as the Global Agenda for Sustainable Livestock.

Table 2. List of submissions to the UNFCCC on topic 2(e) of the KJWA as at September 2020

Parties	Observers
<ul style="list-style-type: none"> • African Group of Negotiators (AGN) • Benin • Senegal • Brazil • Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam as Members of the Association of South-East Asian Nations (ASEAN) • European Union (EU) • Indonesia • Japan • Mexico • Senegal • Switzerland • Vietnam 	<p>United Nations System</p> <ul style="list-style-type: none"> • Food and Agriculture Organization of the United Nations <p>Admitted Intergovernmental Organizations</p> <ul style="list-style-type: none"> • Consortium of International Agricultural Research Centres (CGIAR), International • Center for Tropical Agriculture (CIAT) and World Bank (WB) <p>Non-governmental organizations</p> <ul style="list-style-type: none"> • Conservation International (CI) and the Inter-American • Institute for Cooperation on Agriculture (IICA) • Global Dairy Platform (GDP) • Solutions from the Land (SfL) and the North America • Climate Smart Agriculture Alliance (NACSAA) • World Farmers Organisation (WFO) • Women and Gender Constituency (WGC)

4.3 Options to reduce enteric methane in different livestock systems

Presentations by Juliana Lopes, FAO (Southern and Eastern Africa, Latin America and Caribbean) and Gabriel Teno, FAO (Western Africa).

Globally, livestock systems emit about 3.8 gigatonnes of equivalent carbon dioxide (Gt CO₂ eq) of enteric methane per year (FAO, 2019), which corresponds to approximately one-third of the global anthropogenic methane emissions (Jackson *et al.*, 2020). Despite the sector being the main anthropogenic source of methane, the livestock sector can offer the opportunity to deliver quick and immediate wins for climate change mitigation.

The potential to mitigate enteric methane lies in the wide gap in emission intensities for ruminant products across regions and between and within production systems, particularly in developing countries. It is within this variability that many technical mitigation options can be found, and with the right incentives, they can be exploited to close this gap, while achieving gains in productivity and serving national priorities. In terms of opportunity, methane is a Short-Lived Climate Pollutant (SLCP) and has a life span of about 12 years and a global warming potential (GWP) 34 times greater than CO₂, therefore reducing enteric methane emissions offers the opportunity to reduce the rate of global warming in the near term, making methane a current priority for climate action.

There are strategies and opportunities to improve ruminant productivity and reduce enteric methane emission intensities for ruminant systems. In a collaboration between FAO and Climate and Clean Air Coalition (CCAC) with the support of the Global Research Alliance on agricultural greenhouse gases (GRA), the project “Reducing enteric methane for improving food security and livelihoods”, provided evidence on the mitigation potential and the associated costs and benefits of more than 100 mitigation technical practices and technologies in 13 countries (FAO, 2021c).

The results of the 1st phase of this project showed that most technologies and practices presented the potential to increase ruminant productivity while also reducing enteric methane emission intensity (emissions per unit of product). The project also indicated that investing in technical mitigation options to reduce enteric methane emissions can bring economic returns that will pay off the initial investment and benefit farmers.

The public and private benefits of reducing enteric methane emissions through the adoption of best practices and technologies are numerous and can support economies and peoples in multiple ways. However, the adoption of technologies, in particular of agro-pastoral systems, is challenging. Moreover, reducing emission intensity will lead to lower absolute emissions compared to a business-as-usual scenario (BAU), but this strategy must be combined with practices and measures directed to reduce absolute emissions as well. For instance, increasing carbon sequestration in grasslands, reducing the non-productive use of livestock, particularly in developing regions, and halting livestock expansion into forests are some of the strategies that should be implemented in combination with practices targeting the reduction of enteric methane emissions and emission intensity.

4.4 Access to finance for climate action in the livestock sector: Analysis of Global Environment Facility and Green Climate Fund example projects

Presentations by Saskia Reppin, FAO (Southern and Eastern Africa, Latin America and Caribbean) and Aimable Uwizeye, FAO (Western Africa).

Access to climate finance is key to help countries and communities shift to a more sustainable and resilient food system and thereby address climate change adaptation and mitigation needs. Looking at the Green Climate Fund (GCF) portfolio, the livestock sector receives less funding compared to other sectors that are more attractive for investment because of their ability to demonstrate net emission reduction (FAO, 2018). Emissions from livestock are mainly biologically produced (methane from enteric fermentation and methane and nitrous oxide from manure management) making it unrealistic to achieve net-zero emissions. Further, the sector is heterogeneous with a vast diversity of production systems each requiring specific interventions for climate action. In fact, climate investment and finance for mitigation is mostly directed at sectors where quantification and monitoring of the mitigation benefits is relatively easy and where the economic and political risks are lower. To better access finance, project designers need to comply with Measurement, Reporting and Verification (MRV) frameworks for livestock emissions, which can support the monitoring of mitigation targets. Such projects would also need to provide cost-benefit analyses.

FAO supports countries to access climate finance during the identification, design, formulation and implementation of projects, by working in partnership with international financing institutions. Over the past 14 years, the FAO-Global Environment Facility (GEF) partnership has helped deliver more than 190 projects in over 130 countries across the continent (FAO, 2021d). The FAO-GCF portfolio currently counts 13 FAO-led and approved funding proposals and 40 readiness proposals (FAO, 2021e). FAO also works closely with the World Bank and the International Fund for Agricultural Development (IFAD) and other UNFCCC funds (listed in chapter 4.1).

The GEF is an international co-financing mechanism that provides grants to countries to invest in global environmental projects addressing the critical nexus between agriculture and the environment. Focus is not only on climate change, but in a broader sense on biodiversity, land degradation, international waters and chemicals (GEF, 2021a). The GCF is the largest dedicated fund for climate action. The GCF was established as the financing mechanism by UNFCCC in 2010 to support developing countries and countries in transition to meet the Paris Agreement target of keeping the global temperature rise below 2° Celsius (GCF, 2021). The GCF's Readiness and Preparatory Support programme was set up to support developing countries to prepare conditions to access the fund such as strengthening institutional capacities, governance mechanisms, and country planning and programming frameworks (GCF, 2020).

In past Koronivia workshops organised by the UNFCCC secretariat, Parties to the convention identified the challenges of including multiple benefits in project planning and expressed the need to share information on possible climate solutions across regions. For this series of workshops, 12 GCF and GEF projects which either directly or indirectly included climate action in the livestock sector, were reviewed in detail to identify project components and important elements that they have in common. This review

can help countries to better understand how different elements can be integrated into project design and how climate action can be addressed in the livestock sector. The review identified the ‘enabling environment’ as the most important component of all projects, including activities on strengthening institutions and governance as well as capacity development, awareness-raising and knowledge sharing. Most projects focus on climate change adaptation by enhancing climate resilience of livelihoods, livestock and land, and reducing climate risks through early warning systems. Mitigation efforts are mainly expressed as carbon sequestration in grasslands and through afforestation and by improving pastures and management of forests and rangeland. Other identified project components and elements are: the development of integrated crop-livestock production systems such as silvo-pastoral and agroforestry systems; livelihood diversification through sustainable value-chain development; promotion of investments and financial mechanisms; as well as addressing specifically vulnerable communities. See a visualization of the importance of the identified components and elements in [annex 5](#).

In general, almost half of the analyzed projects demonstrate strong economic or cultural importance of the livestock sector and a strong impact of climate change on the sector. Only half of the reviewed projects suggest direct production improvements in the livestock sector and only the three climate-smart livestock projects aim for a reduction in GHG emission from the sector. Common key characteristics of the reviewed projects include: the integration of projects with national climate change strategies and development priorities; demonstrating country ownership of the proposal; design of integrated projects including multiple sectors and addressing multiple development goals; enhancement of the enabling environment such as institutional strengthening and good governance to overcome and unlock barriers; and de-risking the sector to allow project upscaling and further investments.

Demonstrating GHG mitigation in the livestock sector is a challenge to access climate finance. However, offsets of GHG emissions are possible through the enhancement of soil carbon sequestration in grasslands and silvo-pastoral systems and the generation of renewable energy on farms (e.g. biogas, solar) and the reduction of the deforestation. The livestock sector’s advantage of being both a sink and a source of GHG emissions offers many entry points to access finance, especially through integrated and multi-disciplinary projects.

5. Eastern Africa

5.1 Regional overview and outlook for the livestock sector

Presentation by Ricarda Mondry, FAO Subregional Office for Eastern Africa.

The livestock sector in Eastern Africa supplies substantial numbers of products to domestic, regional and international markets and makes crucial – but often undervalued – contributions to national and regional economies. The sector is highly important for the national gross domestic product (GDP) and livelihoods of people. Livestock contributes to about 20 percent of the total GDP, with Somalia, Kenya and Ethiopia accounting for the highest percentage of population for which livestock is the main source of livelihood. High-quality animal source food plays an important role in household incomes and food security. Livestock provide economic stability to the farm or household, acting as a cash buffer (small livestock) and as capital reserve (large animals) that can be used for purchase of other food groups. Due to population growth, urbanization and increasing income, the demand for livestock products will increase in the region by 2030. Therefore, animal-source foods are expected to contribute proportionally much more to the food supply than they do at present, providing an opportunity to increase incomes of the rural and pastoral population.

Livestock systems rely on natural resources such as grasslands and water, thus it is important to efficiently use the resources through the prevention of overgrazing, facilitation of good rangeland management and storage of feed reserve for a sustainable, climate-smart production. Nevertheless, the sector is facing recurrent challenges due to climate change. The high degree of variability in rainfall patterns, in terms of both space and time, and recurrent droughts and dry spells makes East Africa one of the most vulnerable regions on the African continent for climatic variations. Evidence of climate change in the Intergovernmental Authority on Development region (IGAD) has shown an increase in the incidence of extreme weather events. This situation has resulted in famine and loss of assets for millions of livestock farmers, which in turn could trigger social, economic and political tensions that could cause conflicts, poverty and food insecurity.

To overcome these issues, development strategies need to focus on land-use systems and the natural resources required for improved livestock production. Policies are needed to address issues relating to land use, common property, legislation (price policies, subsidies, national priorities for livestock development and research capacity). Successful livestock development strategies are also needed to advance in resource management planning that complements economic, ecological and sociological objectives. These strategies must consider the social, cultural, political and institutional elements that affect the management of natural resources.

Moreover, the implementation of these strategies will require both technical and institutional support and especially government commitment. Finally, both governments and the private sector will need to increase and coordinate efforts to make an adequate investment through public-private-partnerships on capacity building, awareness creation and development of infrastructures (such as markets, water pans, laboratories, fodder banks, holding grounds, abattoirs, among others).



5.2 Summary of working group discussions

Contributions from Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan.

5.2.1 National initiatives and practices for climate action in the livestock sector

The participating countries from Eastern Africa shared experiences from several existing initiatives, policies and projects on climate change adaptation and mitigation directly or indirectly related to the livestock sector. Overall, the group discussion showed that there is a large difference in policies and strategies implemented at country level to address climate change in the livestock sector or projects aiming to improve GHG inventories. Besides, most countries continue to rely on Tier 1 approach of IPCC guidelines (1996 or 2006) for their national GHG inventories. (IPCC, 2006)

Examples of projects, programmes and policies

In **Kenya**, some projects are addressing the sustainability of the livestock sector mainly by mainstreaming climate-smart livestock approaches across different livestock systems. For instance, the Regional Pastoral Livelihoods Resilience Project and the Kenya Climate-Smart Agriculture Projects funded by the World Bank focus on improving productivity, pasture and prevent degradation, livestock health, ensuring disease control, and reducing GHG emissions, especially in pastoral communities in the North Eastern Development Initiative (NEDI) counties. The Government of Kenya has also developed a National Climate-smart Agriculture Strategy 2017–2026 (Government of the Republic of Kenya, 2017), which provides approaches to guide actions required for agriculture transformation, support agri-food systems development, and ensure food security while reducing GHG emissions, promoting carbon sequestration and adapting and building resilience to climate change. Moreover, Kenya has also developed the National Climate Change Action Plan 2013–2017 (Government of the Republic of Kenya, 2013) and Kenya Vision 2030 (Government of the Republic of Kenya, 2021), and has recently updated its Nationally Determined Contribution (NDC) to the UNFCCC which states the ambition to develop Climate Smart Agriculture (in line with the countries CSA strategy) with an emphasis on efficient livestock management systems (Government of the Republic of Kenya, 2020). Furthermore, Kenya's National Adaptation Plan (NAP) (2015–2030) proposes sectoral adaptation actions including for agriculture and the livestock sector (Government of the Republic of Kenya, 2016).

Rwanda has recently submitted the updated NDC to the UNFCCC (Government of the Republic of Rwanda, 2020), in which climate action in the livestock sector could be achieved through improved livestock husbandry by promoting better livestock feeding, capacity development on better livestock management and reduction of enteric methane in line with the Rwanda Livestock Master Plan (ILRI, 2017). Another strategy is based on the adoption of efficient manure management systems and reduction of associated emissions from small-scale or collective farms. The government of Rwanda has also adopted the Green Growth and Climate Resilience Strategy (GGCRS) to guide national policy and planning to ensure future stability and prosperity in the context of climate change and uncertain energy future (Government of the Republic of Rwanda, 2011). In the short-term, the seven-year Government Programme of National Strategy for Transformation (2017–2024) outlines the need for cross-sectorial coordination to implement environmental policies and regulations in agriculture, urbanization, infrastructure, and land use management (Government of the Republic of Rwanda, 2017). Moreover, Rwanda has also adopted a Strategic Plan for Agriculture Transformation 2018–2024 with the objective of increasing resilience of agriculture to climate change, mainstreaming climate-smart practices across all projects in agriculture and livestock sector (Government of the Republic of Rwanda, 2018). For example, the “One cow per poor family” programme (CIAT Blog, 2017) or the Rwanda Dairy Development Project funded by IFAD (MINAGRI, 2017), aim to improve dairy cattle performance, feed efficiency, and manure management to increase household incomes, reduce poverty and ensure food security while reducing the emission intensity.

Somalia has several projects addressing mainly pastoral communities in drought-prone areas and emergency contexts. The World Bank-funded project “Water for Agro-pastoral Productivity and Resilience” aims to develop water and agricultural services among agro-pastoralist communities in dryland areas of Somalia (The World Bank, 2021a). The Somalia Emergency Drought Response and Recovery Project addresses the immediate needs of drought-affected people and supports resilient recovery through the provision of livelihood opportunities and the restoration of agricultural and pastoral production, as well as enhancing animal health and vector control interventions (The World Bank, 2021). The FAO emergency project on Early Warning Tools for Increased Resilience of Livelihoods in the IGAD Region, addresses the mitigation of impacts of natural shocks, such as droughts, to pastoral and agro-pastoral communities through the deployment of early warning tools, contributing to increased animal feed security and resilience of livestock and livelihoods. Somalia has a National Adaptation Programme of Action (NAPA), which suggests climate change adaptation activities for livestock such as the construction of boreholes and livestock watering points (Government of the Federal Republic of Somalia, 2013). The country also submitted its NDC in 2016 (Government of the Federal Republic of Somalia, 2015). It proposes a project which addresses land management for resilient livelihoods and food security for rural pastoral and agro-pastoral communities. Somalia currently does not have policies (or projects) focusing on GHG emissions accounting or the promoting of biogas. However, the country shows interest in such technologies and projects.

Ethiopia updated its Climate-resilient Green Economy Strategy with a NAP in 2019, which identifies several adaptation options for implementation, e.g. strengthening drought, livestock and crop insurance mechanisms (Government of the Federal Democratic Republic of Ethiopia, 2019). Ethiopia’s Livestock Master Plan (2015–2020) (Shapiro *et al.*, 2015) and the World Bank-funded project Livestock and Fisheries Sector Development Project (The World Bank, 2021b) focus on making the livestock sector more productive and increasing income for rural households and reducing poverty. Ethiopia has also embarked on a Green Legacy campaign to plant billions of trees to tackle the effects of deforestation and climate change (Government of the Federal Democratic Republic of Ethiopia, 2021).

Eritrea submitted its NDC in 2018. One of its planned adaptation goals is to increase livestock productivity by 75 percent by 2030 (Government of the State of Eritrea, 2018). The country is making efforts to intensify livestock production systems, for instance through improved forage and introduction of cut and carry systems and genetic improvements, to reduce pressure on land degradation. Eritrea’s NAPA from 2007 identified major adaptation needs for the livestock sector, such as: the implementation of community-based development and/or rehabilitation of rangelands; selection of animal species and breeds more able to cope with climatic variability; establishment of dairy production and models suitable for specific areas; increasing of job opportunities in order to diversify household income; and reduction of overall livestock numbers, while simultaneously improving productivity (Government of the State of Eritrea, 2007).

South Sudan submitted its NAPA to Climate Change in 2017, which identifies key adaptation needs in agriculture, including the livestock sector, for instance: implement rangeland management plans to control overgrazing and ensure fodder availability under climate change conditions; identify and promote the use of drought-resilient livestock varieties; and strengthen agricultural and veterinary extension services to train farmers on climate-resilient agricultural techniques (Government of the Republic of South Sudan, 2016). Further, planting of trees and promoting agroforestry systems are encouraged through various projects implemented by different UN agencies (UNHCR, 2021; UNICEF, 2021).

5.2.2 Challenges and barriers for climate action in the livestock sector

Despite several livestock projects and national strategies related to climate change, the national GHG emissions inventories in Eastern Africa are still based on Tier 1 approach of IPCC Guidelines, which is inadequate to identify pathways and future scenarios to reduce the emissions from the livestock sector. Using Tier 1 is an obstacle to accurately build the GHG inventories of the sector. Participants, therefore, highlighted the need for capacity development of national technical officers on methods and metrics

based on Tier 2 in line with Measurement, Reporting, and Verification (MRV) frameworks as well as the Enhanced Transparency Framework (ETF) of UNFCCC. Capacity building programmes could focus on data handling, methods and monitoring frameworks, which are fundamental to assess current emissions and track the impacts of implementation measures. For instance, FAO supported the analysis of the GHG emissions from dairy cattle in Kenya, Uganda and Ethiopia using Tier 2, which could be used as a starting point for further application.

Countries emphasized that the impacts of climate change are exacerbated in the region by continuous land degradation due to human activity such as over-cultivation, overgrazing and poor farming practices, expansion of human settlements into forest areas (e.g. in Kenya), unsustainable land use, and weak planning in connection with natural disasters and extreme weather events. These issues represent a big challenge to implement climate actions in the livestock sector, which is increasingly at risk due to increasing water scarcity, low fodder availability in dry seasons, and flooding in the rainy or wet seasons.

Countries also pointed out the region has large and diverse pastoral production systems, which come with particular challenges. The difficulty to control the transboundary movement of pastoralists, the potential conflicts between communities over resources (land and water), and human settlement in natural areas combined with the high frequency of natural disasters, represent big challenges to implement sustainable land management practices.

In the region, there is a serious gap in land use policies as legislation does not focus on the livestock sector. Aspects of climate change and livestock are often handled by different authorities (ministries) and a stronger link between the two topics would be beneficial.

Overall countries highlighted the scarcity of financial resources for funding, implementing and monitoring projects on climate action in the livestock sector. A few countries, however, emphasized that the main issues are related to: i) low resources allocated to government programmes focusing on livestock and climate change, ii) limited extra-budget resources for project implementation in the livestock sector, and iii) limited institutional capacities and frameworks to design successful climate-focused projects.

Moreover, upscaling climate action in the sector requires investment in market access and infrastructure, however insecure land tenure and communal land used by pastoralists represent a bottleneck for investments.

5.2.3 Key actions to improve livestock systems

The countries highlighted the need for policies aiming at improving livestock productivity. There is also the need for institutional and legal frameworks aiming at coordinating different sectors and structured land-use planning. It was also proposed to implement a more robust linkage between global policies and country actions by improving communication and awareness among stakeholders and policymakers.

During the working group discussions, countries exchanged ideas and suggestions on how to improve livestock systems. Such improvements could focus on creating a climate-resilient livestock sector prioritizing fodder production and early warning systems, improving animal nutrition and health, and diversification of the farming systems. There is a need to invest in strategic feed reserves and manage water reserves to prepare for droughts. It was also suggested to map rain land, natural resources and animal distribution and movements, to optimize the utilization of the fodder and to reduce the costs of maintaining animals. One country, Rwanda, also suggested to expand insurance on livestock, due to the diverse risks climate change poses to the sector. Other practices and technical solutions mentioned by the countries to improve livestock systems and thereby contribute to climate action were related to enhancing genetic resources while reducing enteric fermentation. Some relevant examples of these options included: 1) the introduction of new improved livestock species and/or the genetic improvement of the local breeds (shifting from local to cross-breeding to increase productivity) and 2) the introduction of intensive livestock rearing systems where grass is cut and carried to the farm for storage.

It was suggested to improve farmers' and policymakers' awareness on the impact of overstocking and land degradation and the potential for carbon sequestration and to develop farmers' capacities to

adapt technologies. Best practices to enhance carbon sequestration that were identified by participants included improved manure management, rotational grazing, weed and grassland management and the establishment of protected areas for livestock development. Some countries encourage zero-grazing to combat land degradation due to land pressure, combined with improved land management for fodder production. Afforestation, reducing deforestation and promoting agroforestry systems, soil and water conservation activities (through the improvement of rangeland and pastures) were mentioned as other ways to reduce emissions from agro-pastoral systems to enhance carbon sequestration.

Countries proposed to improve research on data collection and handling. Better understanding and farmers' awareness of the interactions between climate change and the livestock sector and its contribution to GHG emissions are needed to identify best practices for including livestock systems into climate action plans. Certain practices and solutions would require the adoption of new technologies and development of farmers' technical capacity to put in practice such climate actions. For example, the on-farm production of energy from manure (biogas) was mentioned as an important carbon offset strategy, which should be encouraged.

Participants identified technology transfer, capacity building and awareness-raising in the community and across the sector as strategies to enhance climate action in the livestock sector. They also mentioned the importance of sharing knowledge and experience through regional platforms and multi-stakeholder approaches and the need to create synergies at regional level. Participants also mentioned the great effort in coordinating research and extensions among African countries but called for more engagement of universities to support relevant research on climate action in the livestock sector.

5.2.4 Views on Koronivia

To the zoom poll question *"Are you involved in the Koronivia process in your respective country level?"* out of nine responses only two confirmed their involvement in the Koronivia process. To the question *"Which of the Koronivia topics are most closely in line with your expertise and background?"* the majority chose Improved livestock management systems with Adaptation to climate change on second rank.

Participants pointed out that KJWA can facilitate knowledge exchange at policy level to provide evidence to develop national policies, regulations and financial backup for countries, and that negotiations are required to facilitate investments to support the countries to address the Koronivia topics.

6. Western Africa

6.1 Regional overview and outlook for the livestock sector

Presentation by Lionel Gbaguidi, FAO Subregional Office for West Africa.

The livestock sector in West Africa contributes directly to approximately 12 percent of the national agriculture GDP (Molina-Flores, Manzano-Baena and Coulibaly, 2020). For pastoral communities, livestock provides more than 80 percent of household incomes. Livestock serves multiple purposes, such as a means to secure children's education and a source of balanced and diversified diets that contributes to the household well-being. It also serves as an insurance capital that helps farmers to overcome other crises such as climate disasters (long droughts or floods). Livestock provides organic fertilizer suitable for crop production and is a source of rural employment for women and youth. The region has the second-largest herd of ruminants in Africa and an extensive Sahel zone, inhabited by a large community of pastoralists, herders and farmers in rural areas whose livelihoods directly depend on the livestock.

According to (FAOSTAT, 2021i), the livestock population is estimated to be 73 million heads for cattle, 130 million sheep and goats, 14 million pigs and 560 million poultry.

Climate change is the biggest threat to food security. The region is currently facing changes in weather patterns leading to more frequent extreme events such as floods, droughts, heatwaves, and forest fires, which increase the vulnerability of rural populations and pastoral communities, resulting in scarcity of feed, water and food. For example, recurrent droughts and floods in the Sahel have resulted in the scarcity of food and water resources for livestock for pastoral communities.

The large size of the ruminant herd contributes significantly to GHG emissions, mainly enteric methane, which exacerbates climate change. Lastly, the current global challenges related to COVID-19 have disrupted the mobility of pastoralists and supply chains, resulting in reduced farm incomes and increase food insecurity.

It is thus very urgent to increase resilience of the livestock sector and its adaptation and mitigation capacity in order to sustainably improve production systems to achieve food security while reducing GHG emissions and protecting the environment.

6.2 Summary of working group discussions

Contributions from Benin, Burkina Faso, Burundi, Cameroon, Côte d'Ivoire, Djibouti, Guinea, Mali, Niger, Senegal.

6.2.1 National initiatives and practices for climate action in the livestock sector

Participants identified several practices that contribute to climate action through the reduction of GHG emissions and carbon sequestration in soils. For instance, in Sahel, the integration of crop-livestock, recycling of manure and use of crop by-products as feed are common practices.

The region has several regionally funded initiatives and projects. For instance, the World Bank project of Regional Sahel Pastoralism Support Project for Africa (PRAPS) is supporting six countries in Sahel (**Mauritania, Mali, Senegal, Niger, Burkina Faso, and Chad**) to develop sustainable pasture management plans through the establishment of dedicated corridors and the promotion of integration of animal husbandry and forestry (The World Bank, 2021c). The project also supports interventions on animal health and access to market. Other practices are the establishment of fodder reserve based on the comprehensive analysis of feed balance in the region. The soils of grasslands in Sahel are degraded, thus efforts to restore them and secure the pastoral areas for regeneration can improve the nutritional quality of feed and increase soil carbon stock.

The GCF funded Programme for Integrated Development and Adaptation to Climate Change in the Niger Basin (PIDACC/NB) aims at improving the resilience of populations and ecosystems in the Niger Basin by managing natural resources sustainably (GCF, 2018a). The programme targets Western African (**Benin, Burkina Faso, Côte d'Ivoire, Guinea, Mali, Niger, and Nigeria**), and Central African (**Cameroon and Chad**) countries. The programme addresses livestock through the establishment of corridors for livestock movement to protect farmers' crops and trees, designating grazing and water access areas to ensure resilience of pastoral production systems, also aiming to prevent conflicts between farmers and pastoralists.

On the research front, the Senegalese Institute for Agriculture Research (ISRA) found in a recent study that methane emissions were affected by the seasonality and feed availability. It also found that default emission factors proposed in the IPCC guidelines overestimate emissions. Moreover, Senegal relies on a pastoral unit approach to improve the fodder storage and availability, reduce land degradation and improve grassland management, and enforce local conventions to protect trees, which can enhance significantly carbon sequestration.

Examples of projects, programmes and policies

Benin lists in its first NDC implementation actions related to agro-pastoral systems, such as development of water and irrigation schemes, the promotion of climate-smart agriculture and the development of and rehabilitation of pastoral areas as well as development silvo-pastoral plantations (Government of the Republic of Benin, 2017). In its Third National Communication to the UNFCCC the country further identifies the promotion of practices of low methane-emitting livestock types and techniques as a measure to implement mitigation options and the need to develop climate-resilient livestock systems for adaptation (Government of the Republic of Benin, 2019).

Burkina Faso has a NAP with specific adaptation proposals for the livestock sector with the objectives of improving the security of pastoralism through better information, improving animal capital protection through climate insurance and improving resilience of livestock farmers and pastoralists through the creation of livestock production intensification areas (Government of Burkina Faso, 2015a). The country's first NDC proposes several adaptation actions for the AFOLU sectors with concrete targets and CO₂ sequestration/offsetting goals for 2030 (Government of Burkina Faso, 2015b). For the animal husbandry sector, those are the rehabilitation of degraded land, fodder collection and storage, establishment of livestock breeding intensification zones and introduction of biodigesters at household level.

Burundi identified, in its first NDC, adaptation needs to reduce the country's vulnerability to climate change and to boost its resilience (Government of the Republic of Burundi, 2015). In its Third National Communication a number of strategic adaptation measures for livestock are listed including enhancing breeders' capacities, promoting small ruminant systems and promoting the production of livestock feeds (Government of the Republic of Burundi, 2019). Burundi also adopted Law No1/21 of 4 October 2018 on "permanent housing and restriction of straying of domestic animals and other backyard animals" (Loi n°1/21 Stabulation permanente et interdiction de la divagation des animaux domestiques et de la basse-cour au Burundi).

Cameroon developed its NAP with strategic recommendations for the livestock sector in 2015 (Government of the Republic of Cameroon, 2015a). Suggested measures are: rehabilitation of breeding stations and pastoral land; development of livestock water points; rehabilitation of degraded rangelands; monitoring, production and storage of fodder; promoting livestock intensification and integration of agro-silvo-pastoral systems; and integrating climate change risks in the pastoral code. The World Bank-funded Livestock Development Project aims to improve the productivity of livestock production systems in the country, including the improvement of local animal breeds and pastures (The World Bank, 2016). In the country's Second National Communication, some mitigation options are proposed, such as reducing the pressure on pastures, better manure management and use of livestock by-products to create bioenergy on farms (Government of the Republic of Cameroon, 2015b).

Côte d'Ivoire has expressed livestock-related mitigation and adaptation actions in its first NDC (Government of the Republic of Côte d'Ivoire, 2016) and Third National Communication (Government of the Republic of Côte d'Ivoire, 2017). Suggested strategies are to intensify animal production, to promote crop-livestock integration, the development of dams for water management in agro-pastoral areas, and to improve fodder production and manure management. The country has also received support through the National Adaptation Plan Global Support Programme (NAP-GSP) to advance its NAP process (UNDP, 2015). The Climate-Smart Agriculture Investment Plan proposes the development of a climate-smart livestock project in northern Côte d'Ivoire. The project will increase the productivity and climate resilience of the livestock sector through climate-smart practices, infrastructure development and scientific research (World Bank Group, 2019a).

Djibouti has received support through the NAP-GSP to advance their NAP process seeking to identify adaptation measures for the agriculture and livestock sector (UNDP, 2019). Some adaptation measures are already being implemented through funded projects listed in the countries first NDC (Government of the Republic of Djibouti, 2015). Among others, the project Developing Agro-Pastoral Shade Gardens in Djibouti has the objective to diversify and promote climate-resilient agro-pastoral practices (Adaptation Fund, 2018). The Rural Community Development and Water Mobilization Project aims to enhance rural communities' capacity to manage water and agro-pastoral resources (The World Bank, 2019).

Guinea has formulated in its first NDC the commitment to support the adaptation efforts of rural communities to develop agro-silvo-pastoral techniques, through better management of pastoralism (including transnational) to limit degradation of grazing and soil and to reduce the risks of conflicts (Government of the Republic of Guinea, 2015). Guinea's Second National Communication states the need to update the country's livestock development policy to promote better feeding strategies and to promote agriculture and livestock integration to improve productivity of agro-pastoral farms (Government of the Republic of Guinea, 2018). The Strengthening Climate Information and Early Warning Systems for Climate Resilient Development and Adaptation to Climate Change project will help Guinea to respond to shocks and to mainstream adaptation into development planning for climate-sensitive sectors (agriculture, livestock, water, coastal and forestry areas) (UNDP, 2019).

Mali has identified a conditional mitigation target for the agriculture sector in its NDC, suggesting better manure and fertilizer management (Government of the Republic of Mali, 2016). The adjustment of stocking rates in pastoral areas was mentioned as one of the mitigation technologies for the agriculture sector in its Third National Communication (Government of the Republic of Mali, 2018). Mali's Climate-Smart Agriculture Investment Plan proposes among others, to increase farm productivity and minimize climate risks by providing producers, extension agents and agribusiness with best management practices and tools for crop-livestock integration (World Bank Group, 2019b). The improvement and adaptation of animal breeds and forage species is listed in the countries NAPA (Government of the Republic of Mali, 2007). There are several adaptation projects for the agro-pastoral communities. However, the country still has to develop its NAP. The GEF-funded and FAO-implemented project "Strengthening Resilience to Climate Change through Integrated Agricultural and Pastoral Management in the Sahelian zone in the framework of Mali's Sustainable Land Management Approach" focused on boosting the capacity of Mali's agro-pastoral activities to cope with climate change (GEF, 2021b).

Niger states in his NDC the intention to upscale its Strategic Framework for Sustainable Land Management (2015-2029) to align with climate change adaptation and mitigation measures (Government of the Republic of Niger, 2015). The SLM practices are implemented through projects that, among others, aim to improve agro-pastoral productivity through grassland restoration (FAO, 2020a). Niger has several projects and national programmes in place that support adaptation to climate change by building resilience. For example, the Support Program for Livestock Development aims to make livestock systems more sustainable, resilient and efficient. The project aims to build resilience of agro-pastoralists by improving food security, enhancing access to secure pastoral areas, developing value chains and improving governance of the livestock sector (Government of the Republic of Niger, 2019).

Senegal has prioritized several adaptation measures for the livestock sector in its NDC, such as: strengthening early warning systems and climate information, sustainable management of pastoral resources, including livestock corridors, cross-border management, integration of fodder and crop production, promoting livestock insurances, improving livestock health, productivity and genetic resources (Government of the Republic of Senegal, 2020). The FAO project Strengthening Agricultural Adaptation (SAGA) (2010–2021) supports the NAP process and the development of a plan to implement those adaptation measures from the country's NDC. The project also looks at the performance and adaptation of livestock systems and milk and meat value chains (FAO, 2020b).

6.2.2 Challenges and barriers for climate action in the livestock sector

Participants mentioned the limited synergies between the Ministry of Environment, the Ministry of Agriculture/Livestock and other national authorities addressing climate change issues. Often, there is limited collaboration between national livestock and climate change officials. Aligning the livestock sector needs with national the climate change agenda requires political will and increased awareness of the vulnerability of the sector to climate change and its contribution to GHG emissions.

Participants identified the inappropriate and insufficient national budget allocated to the livestock sector as a major underlying obstacle to implement adaptation and mitigation interventions. For instance, in Senegal, public investments in the livestock sector are lower as compared with those allocated to other economic sectors.

Moreover, participants highlighted constraints to access finance due to countries insufficient capacity to fulfil the climate funds' specific requirements regarding application processes and project design.

Many countries have committed to reducing emissions from the AFOLU sectors. However, there are very few concrete mitigation commitments for the livestock sector. The issues mentioned are the limited technical capacity, lack of robust baseline analysis and data availability to demonstrate the mitigation benefits and socio-economic outcomes of different interventions. These issues constitute a major constraint to developing scenarios and models necessary to inform policymakers, to identifying best practices and technologies and to monitoring progress towards low emission development targets.

As the Sahel region is vast and pastoralists are in constant mobility, it is difficult to implement best practices interventions focusing on animals. Thus, most interventions focus on natural resource management, efficient use of water, prevention of bush fires and establishment of fodder bank.

Moreover, the difficulty to approach pastoralists and raise awareness on climate change issues, as well as to overcome behaviours change, hinder the efforts to implement climate action in this system.

6.2.3 Key actions to improve livestock systems

Participants mentioned the need to differentiate solutions according to the different farming systems, as well as to consider species other than ruminants in the mitigation approaches. Improving livestock systems requires first diagnostics of existing production systems and second defining means of optimization for each system. It is also necessary to adopt existing technologies such as artificial insemination, the conservation of fodder resources, and the improvement of nutritional value of feed.

Most countries highlighted the need to develop and implement policies that promote access and use of new technologies. GHG emissions reduction targets should be included in national livestock's policy frameworks. This requires enhancing public investments for the livestock sector at the country level. Financial incentives are also needed to adopt more sustainable practices on the ground, such as improving pasture management to reduce conflicts, modernizing livestock techniques in the various systems, improving animal feed and health both for ruminants and monogastric animals, and improving manure management. Promoting crop–livestock integration as an economic vision to encourage farmers to adopt such practices, as well as to strengthen the collaboration between associations of crop producers and livestock keepers.

Also, economic operators as potential investors should be identified and made aware of the complex interactions between climate change and livestock sector in order to ensure the sustainable development

of the sector in a win-win environment. For private investments and climate finance funds, there is a need to develop robust projects that can demonstrate tangible mitigation benefits starting from baseline assessments. Hence, the priority would be to carry out data collection and analyse the baseline situation for different livestock systems, including the pastoral system. Such information would be used to support the design and formulation of projects for climate finance. Moreover, there is a need to develop the capacities of livestock actors to be able to write and submit bankable projects, as well as implement them.

Capacity development is needed and must be a priority to set up climate-friendly livestock projects, as well as to improve the MRV framework to better account for GHG emissions in national inventories. Participants pointed out the need for scientific expertise of FAO in supporting countries to build their GHG inventories. Programmes for capacity development can focus on both Ministry of Environment and Ministry of Agriculture/Livestock and other government agencies. Furthermore, better communication and awareness-raising among stakeholders and policymakers about the Koronivia Joint Work on Agriculture is a prerequisite for the establishment of climate action in the livestock sector. Additional capacity building is needed on feeding strategy and grassland management.

Participants also mention the need to develop a regional framework for collecting and sharing information on livestock systems between practitioners and researchers. This need was emphasized by the African Group of Negotiators on Climate Change, as it would help to better define the regional research priorities on livestock systems and climate change. It was suggested to have a regional approach to livestock climate actions and to develop a regional project on climate-smart livestock production. Achieving climate action needs to be inclusive and must involve all stakeholders, from the scientific community to producers; the latter need to be better informed and trained to understand the magnitude of the issue.

Regarding the data, an adequate national herd census is needed for reliable statistics on the number of animals in the region. This census cannot be limited to animals and should be extended to the entire livestock value chains. These data can then be used to estimate the feed requirement and the potential future demand for animal-source food in the regions.

6.2.4 Views on Koronivia

A poll conducted during the workshop showed that only 35 percent of participants were involved in the Koronivia process. The majority of participants mentioned that their work related to two topics of KJWA: Adaptation to climate change and Improved livestock management systems.

Only a few countries are involved in Koronivia process, it was agreed that all countries need to be involved to show the uniqueness of the agro-pastoral systems in the Sahel and their vulnerability to a changing climate. It was suggested to form a Koronivia group that would identify national priorities to be shared with the African Group of Negotiators on Climate Change, which will channel them to the negotiation table at the Convention. Another suggestion was to promote the collaboration between livestock stakeholders, scientists, negotiators and UNFCCC focal points to ensure that livestock issues are included in submissions and negotiations.

7. Southern Africa

7.1 Regional overview and outlook for the livestock sector

Presentation by Berhanu Bedane, FAO Subregional Office for Southern Africa (SFS).

The livestock sector in Southern Africa has a large number of livestock, diversified species and breeds, with about 75 million heads of cattle, 78 million goats, 58 million sheep, close to half a billion chickens and about 17 million pigs, with the latter being the largest in whole Africa (FAOSTAT, 2021i).

Livestock contributes significantly to agricultural regional GDP with about 30 percent on average and up to 85 percent, in Botswana for example. Livestock is an important source for household food security and nutrition with high-quality proteins, minerals, vitamins and micronutrients and remains an important livelihood asset and coping mechanism in case of crop failure for rural livelihoods, especially women. The sector, however, has not yet shown its full production potential of animal sources food (ASF) and consumption is still low. Substantial amounts of ASF (meat and milk) are being imported for a value of about USD 1.7 billion.

The region has made significant progress in the control of major animal diseases. The only region in Africa where most countries are free from Peste des petits ruminants (PPR), Foot-and-mouth disease (FMD) and Contagious bovine pleuropneumonia (CBPP). Contrary to other parts of Africa, the livestock sector is better organized with substantial value addition to livestock products such as beef. Therefore, the region is able to access high-value markets such as the European Union, the United States of America and some parts of Asia.

The sector is extremely vulnerable to climate change and extreme weather conditions, which increases the frequency of droughts, floods and fires with severe impacts on livelihoods and production systems. Besides climate change, the global COVID-19 pandemic has disrupted supply chains due to restriction of movement, resulting in a reduction of markets access, farm incomes and affecting food security. The threat of major animal diseases entering or re-entering the region prevails a major challenge. Further challenges are the low production and productivity among subsistence farmers and the low volume of investments and limited access to international markets.

Despite all those challenges, livestock is the fastest growing agricultural sub-sector in the region. The demand for ASF is growing due to rapid population growth and a shift in consumer preference of a growing middle class. A fourfold increase by 2050 for eggs and poultry is expected.

In line with international commitments to the SDGs, there are regional strategic development plans to increase productivity to ensure food security and nutrition and reduce poverty by building sustainable, climate-smart, inclusive and resilient agri-food systems. Proper management is needed to increase production in a sustainable and responsible manner, to avoid risk of production intensification such as increase of Antimicrobial Resistance (AMR), re-emerging zoonotic disease, environmental pollution and animal welfare issues. To address climate change mitigation and adaptation actions in the livestock sector, a better understanding of climate change impact is needed. Disaster risk management, early warning systems, improvement of animal genetic resources, animal disease control, natural grassland and water resource management, as well as a better enabling environment with policies and an institutional framework for investment, and better market access.



7.2 Summary of working group discussions

Contributions from Botswana, Eswatini, Lesotho, Madagascar, Malawi, Mozambique, South Africa, Zambia.

7.2.1 National initiatives and practices for climate action in the livestock sector

Countries from the Southern Africa region shared their experience on some existing national initiatives, policies, strategies, and projects aiming to build more resilience while combining mitigation and adaptation efforts. Participants identified best practices to improve livestock systems and enhance carbon sequestration, such as developing agroforestry systems using fodder trees, improving animal health through better disease control and nutrition, and promoting renewable energy on farms and better manure management.

Examples of projects, programmes and policies

Botswana submitted its Third National Communication to UNFCCC in October 2019 proposing adaptation practices to improve livestock resilience to climate change (Government of the Republic of Botswana, 2019). It builds on the identified adaptation strategies for the livestock sector in the country NDC submitted in 2016 (Government of the Republic of Botswana, 2016). One national programme to support and improve livestock systems is the Integrated Support Programme for Arable Agriculture Development (ISPAAD) which provides subsidies and grants for farmers to grow fodder (National Development Bank, 2015).

Eswatini's first NDC mentions the selection of livestock breeding as an intervention to support climate change adaptation (Government of the Kingdom of Eswatini, 2016). Through a CCAC (Climate and Clean Air Coalition) funded project, FAO is currently supporting the development of a Tier 2 GHG inventory in the livestock sector.

In **Lesotho** the Wool and Mohair Promotion Project (WAMPP) funded by IFAD, focuses on climate-smart rangeland management, improved production and management of livestock and improved handling and marketing strategies for wool and mohair fibres. It includes a special sheep exchange programme, where less productive animals can be exchanged for more productive ones (IFAD, 2021). The country is currently reviewing its rangeland management act to ensure more sustainable rangeland management.

Madagascar is in the process of finalizing its NAP, which prioritizes sustainable practices of extensive grazing, improving farm animal resilience through safeguarding local breeds with climate stress and disease resistance, strengthening animal health, preserving and securing agro-pastoral areas, soil, water and biodiversity, and promoting scientific research and technology to better understand the impact of climate change on livestock (UNDP, 2021).

Malawi submitted its NDC in 2017 and it includes mitigation and adaptation options to improve livestock systems (Government of the Republic of Malawi, 2017). The country has also developed a Nationally Appropriate Mitigation Action (NAMA) in 2015, which proposed the improvement of livestock feeding systems as mitigation action (Government of the Republic of Malawi, 2017).

Mozambique developed a NAPA in 2007, which included livestock in its expected short and long-term results. It aimed to reduce livestock losses due to drought and other climatic events as well as increase feed availability (Government of the Republic of Mozambique, 2007).

South Africa's Land Care Programme is a government-supported community-based initiative, aiming at conserving natural resources, using them in a sustainable way, creating a conservation ethic through education and awareness and creating jobs and addressing poverty by launching various natural resource rehabilitation, improvement and conservation projects (Government of the Republic of South Africa, 2021).

Zambia has several projects funded by different development partners on supporting climate-smart-livestock production, e.g. The GEF Climate Resilient Livestock Management Project aims to strengthen the adaptive capacity of Zambian livestock farmers to the impacts of climate change (GEF, 2020a). Zambia has recently updated and revised its first NDC submitted in 2016, which considers mitigation co-benefits resulting from adaptation strategies such as diversification and promotion of Climate-Smart Agricultural (CSA) practices for livestock (GEF, 2020a).

7.2.2 Challenges and barriers for climate action in the livestock sector

The livestock sector is extremely vulnerable to climate change. Heat stress and flooding have an impact on fertility and productivity affecting food security. The challenges identified were namely population growth, pressure on natural resources, increasing demand for animal-sourced food and land degradation due to high animal density, in particular for communal grazing systems. Moreover, it is important to reconcile mitigation and adaptation options and food security in implementing climate action.

The limited knowledge and technical capacity of farmers on the role of livestock in climate change hinder the implementation of climate action in the sector. Further, the limited access to technologies and innovative solutions and inadequate infrastructure for livestock are barriers to the implementation of climate action on the ground.

Regarding GHG emissions, participants highlighted the limited capacity to conduct GHG emission inventories, data collection and analysis and to comply with MRV requirements according to UNFCCC. Country specific data and emission factors of different breeds and production systems are needed to move from Tier 1 to Tier 2 approach. Countries have only a limited number of officials that can conduct GHG inventories and very limited capacity to access climate funds needed to develop such capacities.

Insufficient coordination between Ministries and other Government agencies and issues of alignment of national and provincial policies need to be overcome together with enhancing institutional capacities to implement climate action on the ground. Conflicting and outdated policies were also mentioned as a major barrier, e.g. forestry and land use legislations.

Furthermore, inadequate national budget allocation along with limited financial resources have also been pointed out as obstacles for the implementation of climate actions and transfer of new technologies.

7.2.3 Key actions to improve livestock systems

A good enabling environment with adequate policies and frameworks as well as access to financial resources are key requirements to improve livestock systems and to implement climate action on the ground. It was suggested, to incorporate climate change aspects in national livestock development policies, strategies and planning as well as to develop policy and legal frameworks to better manage grassland and to control the expansion of cropland into forests.

The importance of research on the impacts of climate change on the livestock sector was highlighted, specifically on animal fertility and genetic resources as well as on drought-resistant fodder crops and breeds. It was suggested to mainstream climate change and livestock interactions in university curricula as one way to improve awareness and develop capacities. Moreover, during the design of projects on climate-smart livestock, it is necessary to recognize and incorporate the role of livestock for rural households, especially women and youth, in terms of nutrition, food security, income, and as economic assets.

Some countries identified the promotion of grass-fed systems, contrary to highly intensive feedlot systems, as a best practice to reduce total GHG emissions from the sector. The improvement of grassland and rangeland management systems can offset emissions through soil carbon sequestration and contribute to the prevention of wildfires. To address the issues of overgrazing, countries mentioned the need to raise awareness among farmers and to understand how practices can be mainstreamed on the ground through behaviour change, especially for communal grazing systems.

Further, innovative solutions, tools and methodologies for livestock keepers need to be easily adaptable and tailored to local conditions. The establishment of agroforestry systems as a source of energy and to enhance carbon sequestration was also mentioned as a means to reduce over-exploitation of indigenous forest.

7.2.4 Views on Koronivia

A poll conducted during the workshop showed that only 38 percent of participants are involved in the Koronivia process. The majority of participants mentioned that their work related to two topics of KJWA: Adaptation to climate change and Improved livestock management systems.

The KJWA provides a platform for sharing knowledge and facilitating countries to work together and share experience. KJWA can help to mobilize resources and develop capacities in order to implement the Koronivia outcomes and climate actions. Participants pointed out the need to raise awareness on the Koronivia process among national livestock stakeholders. This workshop was a good example of sharing experience and knowledge and calling for more engagement at country level in the Koronivia roadmap.

8. Latin America and the Caribbean

8.1 Regional overview and outlook for the livestock sector

Presentation by Carolyn Opio, FAO Subregional Office for Mesoamerica.

Livestock production in Latin America and the Caribbean (LAC) is immensely diverse in terms of production systems, economic importance and its contribution to income, technological sophistication, employment and trade. Large, capital-intensive, export-oriented farms coexist with small, labour-intensive, and subsistence-oriented farms. Between these two extremes, there is an intermediate sector that can connect to markets, but remains extremely vulnerable to economic and other shocks, including climate risks. Also in terms of trade, the Southern Cone countries are among the world's largest exporters, while the Caribbean countries depend on imports from world markets to meet their food needs. Although LAC represent only about 8 percent of the world's population, the region produces more than a quarter of the world's beef, almost 24 percent of the world's poultry, 11 percent of the world's milk, and 7 percent of the world's pork.

Adoption of new technologies and production practices, including improved breeds, has fostered increased production efficiency in all livestock species and regions of Latin America. Growth in meat and milk production, however, has been mainly the result of an overall increase in livestock inventories rather than yields. Poultry and swine productivity growth since 2000 have been the result of production scale and vertically integrated efficiencies. The growth of the region's livestock systems has generated employment and income and fostered economic multiplier effects that have supported economic development efforts throughout the region. The livestock sector now represents 42 percent of Latin America's agricultural GDP with 75 percent of production concentrated in five countries – Brazil, Uruguay, Paraguay, Mexico and Argentina. The region's livestock sector has also generated positive impacts on food security and livelihoods. Approximately 80 percent of the livestock producers in the region are small family farmers, who develop an extensive and rural livestock tradition.

The LAC region has also become a major global supplier of animal products. The region has benefited from the growing demand for agricultural products, particularly in Asia. Currently, the region accounts for almost 15 percent of world food exports and provides 60 percent of world soybean exports, 44 percent of beef, 42 percent of poultry and 33 percent of corn. Overall, exports of livestock products tripled from 4.4 million tons in 2000 to 13.5 million tons in 2013. However, more than 43 million of its inhabitants are undernourished.

The region is facing different challenges to sustainably maintain and increase production in the future. Meeting the growing demand will put pressure on the advance of the agricultural-livestock frontier to areas of greater environmental vulnerability. This can increase the levels of deforestation in the region, the degradation of soils, the loss of biodiversity and the reduction of the water resource if measures are not taken to avoid it. At the same time, climate change is already having significant negative impacts on the sector's productivity.

As growth continues, the need to keep emissions low in the LAC region presents an urgent challenge. Emissions from agriculture increased by 19 percent between 2000 and 2014 and the sector now contributes 23 percent to the region's total. Sustained global economic growth in the region is increasing emissions from energy, transport and agriculture. Most LAC countries make minimal contributions. However, the region includes some important carbon emitters: countries with high rates of deforestation and countries in transition, with high growth rates.

Progress and transformation of the livestock sector offer economic opportunities, food security and nutrition, and poverty reduction. The possible risks that the development of livestock farming may represent for environmental and human health must be addressed in order to guarantee the sustainability



of the sector and that opportunities reach poor and marginalized people, such as small farmers, women and youth. LAC's abundant natural resource endowments will allow the region to continue to play an important role in world agricultural production and trade. The challenges for the future lie in sustaining growth without increasing its environmental footprint. For that agriculture in Latin America must become more sustainable.

8.2 Summary of working group discussions

Contributions from Brazil, Chile, Costa Rica, Dominican Republic, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay.

8.2.1 National initiatives and practices for climate action in the livestock sector

Participants from the LAC region exchanged their experience on nationally implemented projects and initiatives related to climate action in the livestock sector, including some projects that can account for reduced emissions and improved productivity in the livestock sector. Several countries are currently implementing their NDCs through national sectorial plans and policies, including the livestock sector. Participants pointed out that establishing national political landmarks is the first step to support change on the ground, followed by technology transfer, capacity development, and the need to raise climate change awareness among farmers.

The enhancement of soil organic carbon (SOC) sequestration and its accounting in national GHG inventories were important topics of conversation among participants. Several good practices to enhance carbon sequestration were listed, such as rangeland and pasture restoration, integrated silvo-pastoral systems, improved grazing management, reseeding degraded pastures, establishment of forage banks in areas not suitable for crop cultivation, and inclusion of trees and legume forages to increase carbon and nitrogen inputs in the soil. Further, reforestation, avoiding deforestation, manure management to generate renewable energy as well as nutrient recycling were mentioned as practices to capture or offset carbon emissions.

Some countries in the LAC region are already using national emission factors for estimating livestock emissions in their GHG inventories. However, most countries still use Tier 1 emission factors.

Examples of projects, programmes and policies

Brazil has implemented policies and programmes that have contributed to improve livestock production and the sustainability of the sector over the last ten years. The country has invested in research, planning and the development of policies such as the National Plan for Low Carbon Emission in Agriculture (ABC Plan) (Government of the Federative Republic of Brazil, 2018), which is a sectoral plan under the National Policy on Climate Change. Through the first phase of the programme, the country has seen improvements in productivity (18 percent in beef production and 48 percent for milk) while livestock emissions increased by only 2 percent. While the ABC Plan is a national programme, it was developed based on regional capabilities and priorities. Brazil is currently defining the next targets and plans and improving the sustainability of the sector through adoption of region-specific policies based on science.

Chile has updated its first NDC in 2020. Within its NDC, the integration of livestock and forest conservation management systems is one proposed action under its commitments on reducing emissions from the forestry sector (Government of the Republic of Chile, 2020). Chile is currently updating its Sectoral NAP with measures for the next five years (Government of the Republic of Chile, 2017). Moreover, there is currently a law under legislative review to promote the sustainability of the sector and reduce emissions through adaptation practices with the aim to permanently implement NDC commitments at national policy level.

Costa Rica has developed a National Low-Carbon Livestock Strategy (Government of the Republic of Costa Rica, 2015a) and a NAMA for the livestock sector with specific mitigation targets for livestock

(Government of the Republic of Costa Rica, 2015b). Moreover, the United Nations Environment Programme has recently supported Costa Rica to develop a business case analysis of low-carbon livestock production, which has confirmed that the adoption of technologies and practices suggested in the NAMA, can result in increased financial and climate performance of farmers (UNEP, 2020). Costa Rica is currently building a program to measure the carbon footprint of some agri-food products and to create a label to facilitate the identification of sustainable agri-food products.

Mexico has recently updated its NDC which includes adaptation and mitigation considerations for the livestock sector (Government of the United Mexican States, 2020). Mexico's National Climate Change Strategy (Vision 10–20–40) lists mitigation actions for the agriculture and forestry sector, including the increase of silvo-pastoral systems and improved pasture management to increase carbon capture and reducing stocking rates (Government of the United Mexican States, 2013).

Nicaragua has been working to include the livestock sector in the national political agenda, since the sector was included in the recently updated NDC (Government of the Republic of Nicaragua, 2020). The NDC suggests the need to develop a NAMA for the livestock sector to address the issue of deforestation caused by extension of livestock activities into forest areas. Further, it suggests the development of a national management plan for GHG emissions from livestock through enteric fermentation and manure management through biodigesters.

Panama has recently updated its NDC, including ambitions to transform the livestock sector to be more sustainable and productive by developing mitigation and adaptation strategies (Government of the Republic of Panama, 2020). In its NDC, Panama commits to develop a NAMA for the livestock sector by 2030 and a National Framework for Climate Transparency (GEF, 2020b). The country is also working on environmental accounting of the livestock sector to understand the economic and environmental costs to better direct public investments and attract external sources of investments.

Paraguay is in the process of updating its NDC including easy measurable targets and sectoral plans (Government of the Republic of Paraguay, 2016a). The country also has NAP including the agriculture and livestock sector (Government of the Republic of Paraguay, 2016). The livestock sector is making efforts to establish more specific and related policies. The agriculture and livestock sector was the first sector to have a National Plan for Risk and Disaster Management and Climate Change Adaptation (2016–2022), given the strong impact of climate change on the sector (Government of the Republic of Paraguay, 2016b).

Peru has recently updated its NDC (Government of the Republic of Peru, 2020). Peru is developing adaptation and mitigation measures for the livestock sector that are specific to each agro-ecological zone in the country. The National Livestock Development Plan (2017–2027) proposes strategies to increase livestock productivity through the application of sustainable and conservation grazing practices, genetic improvement, adequate feeding strategies and the application of technologies (Government of the Republic of Peru, 2017).

Uruguay launched its NAP (Government of the Eastern Republic of Uruguay, 2019) for the agriculture sectors in September 2019, which was developed to achieve the national adaptation and mitigation commitments established in their first NDC (Government of the Eastern Republic of Uruguay, 2017). The NAP was developed with the support of the Integrating Agriculture in National Adaptation Plans (NAP-Ag) programme, jointly coordinated by FAO and the United Nations Development Programme (UNDP) (FAO, 2021h). The GEF project on Climate-smart Livestock Production and Land Restoration in the Uruguayan Rangelands was approved in 2019 and has the objective to mitigate climate change and to restore degraded lands through the promotion of climate smart practices in the livestock sector, with a focus on family farming (GEF, 2020c).

At regional level, GCF project Productive Investment Initiative for Adaptation to Climate Change (CAMBio II), is a joint project of the countries: **Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama and the Dominican Republic**. It finances ecosystem-based adaptation measure, including the establishment of agro-silvo-pastoral systems, for micro, small, and medium-sized enterprises (GCF, 2018b).



8.2.2 Challenges and barriers for climate action in the livestock sector

Participants pointed out that many challenges lie in demonstrating the co-benefits of mitigation efforts. Adaptation to climate change is important to make the sector more resilient while preserving natural resources and ensuring food security needs. Some countries still struggle with hunger and adequate nutrition, through access to animal products, which makes it key to find mitigation options without compromising food security.

Barriers to climate action on the ground are related to, lack of economic incentives and insufficient financial resources for farmers to adopt new technologies. For example, silvo-pastoral systems, require high initial investments which can prevent broader practice uptake. Moreover, farmers usually are not aware of the linkages between livestock and climate change and vice-versa, and the role they can play in leading climate action. There are also cultural and traditional barriers that limit technology uptake. Although many mitigation/adaptation practices are cost-effective, technological uptake is low due to limited technical capacity of farmers.

Some participants also identified limited political will as an obstacle. Unforeseen changes in political priorities, weak institutional capacity and limited coordination among authorities and ministries are barriers to implementing climate action in the livestock sector.

Agriculture subsidies were also mentioned as a barrier to climate action. They can distort local markets and are not fair for farmers that have higher production costs due to the adoption of climate/environmental practices.

Participants also mentioned the negative image of the sector, because from a consumer point of view livestock production is often considered unsustainable. In this context, demonstrating the efficiency of livestock production systems is challenging and requires resources and detailed analysis.

Accounting for soil organic carbon (SOC) and thereby demonstrating the GHG emission offset potential of grassland-based systems is another challenge. There is insufficient information available on national emission factors, time-series data for land use change (LUC) and agricultural management practice estimate a baseline. Further, SOC sampling, measuring and monitoring are very costly and only a couple of countries have the needed technical capacity to estimate soil carbon dynamics.

Application of GHG accounting methodologies, tools and MRV systems pose major challenges to countries. The diversity of livestock systems in many countries and the need for high data intensity come along with high costs of implementation. While several countries emphasized the need for simplified accounting methods, they also mentioned the need to consider the particularities of each production system and agro-ecological zones (AEZ).

8.2.3 Key actions to improve livestock systems

Better grazing management practices, restoration of degraded pastures, upscaling silvo-pastoral systems and improving production efficiency were the technical options often cited by the countries to improve livestock systems and to contribute to climate action.

Several countries mentioned the necessity of developing public policies based on science. Moreover, given the differences within countries, in terms of AEZ and production systems, national policies and programmes should consider this diversity and be system-specific. Models and cost-benefit analysis of interventions and best practices on the ground are required to inform policymakers. Demonstrating the co-benefits of mitigation options, such as increased economic returns to implementing farmers is needed to support adoption of new practices. Payments for ecosystem services and economic compensations for farmers were cited as possible strategies to leverage the barriers in technological adoption.

Further, a better understanding of the extended co-benefits, as well as trade-offs from the sector are important to direct public investments and attract external sources of investments. For example, the livestock sector uses land that is not adaptable to crop production and good managed grassland

contributes to biodiversity conservation. Identification of criteria and national priorities for long-term sector development is needed to facilitate countries' access to climate finance.

The creation of markets and value chains for sustainable livestock products was suggested as a way to support farmers to adopt sustainable best practices and benefit through added value. Hence, the development of certification and labelling schemes was suggested as another option to support farmers' adaptation of practices, while attending both domestic and international consumer demand for sustainable livestock products. A market mechanism based on the carbon balance or sustainable farming practices was also mentioned as a possible strategy to benefit farmers who adopt such best practices.

Given the extensive grasslands in the region, several countries mentioned that a holistic approach is appropriate to account for all the sinks and sources of GHG emissions. Thus, GHG emissions from grasslands and forests under silvo-pastoral systems should be included in the sector's GHG accounting. The use of regional data is essential to develop GHG inventories. This can be combined with an integrated landscape approach to explain the complexity of livestock systems and to support decision-making. In this context, monitoring SOC at a landscape level by using satellite imaging (to monitor land use changes) and grassland root mass production (as a proxy) were mentioned as "low-cost" monitoring strategies.

Regarding the national GHG inventories, countries highlighted the need to improve the quality of the livestock activity data to generate national emission factors (EF) that can capture the national circumstances and particularities. The diversity and complexity of livestock production systems need to be incorporated into the national GHG inventories. Despite the need for system-specific analyses, most countries still rely on default regional EF. It was suggested to use the Global Livestock Environmental Assessment Model (GLEAM) (FAO, 2021f) to identify GHG emissions hotspots and areas with potential improvements.

Mitigation efforts can go hand-in-hand with adaptation practices. The livestock sector can aim for win-win-win opportunities, where systems become more resilient, more productive and lower in emissions. To achieve this, the holistic approach can be used to assess the environmental perspective, social and economic dynamics as well as impacts of climate change on the sector. It is therefore fundamental to understand how the sector will respond to different climatic and policy scenarios through integrated analysis and modelling.

The provision of technical assistance and capacity development for farmers, dissemination of knowledge through roundtables, multi-stakeholder approaches and pilot farms were mentioned as an effective outreach strategy. This strategy can help to overcome cultural and traditional barriers that limit technology uptake for sustainable transformation of livestock systems. Education and awareness-raising campaigns for both farmers and consumers about climate change and sustainable agriculture production were suggested.

8.2.4 Views on Koronivia

The KJWA was viewed as an excellent opportunity for exchanging scientific knowledge and experience among countries. KJWA facilitates collaboration to support the implementation of practices for livestock climate action based on science and adequate indicators that take into consideration food security and the vulnerability of the sector under climate change. The KJWA can facilitate access to climate finance, technology and capacity building for improved agricultural practices and can increase national climate ambition by including the livestock sector.

Countries mentioned the need to develop an implementation strategy/roadmap, together with the implementing and financing agencies, UNFCCC secretariat and stakeholders, to support the implementation of a global climate action plan for the agriculture sector.

Some participants took the opportunity to remind attendees about the upcoming KJWA meetings, submission deadlines and the importance of reflecting regional visions in Koronivia discussions.

9. Synthesis of discussions

There was good participation and involvement in all four workshops. Each region demonstrated its individual circumstances and challenges which require diverse actions. However, key discussion points across all regions can be summarised as follows in this chapter.

9.1 Climate action in the livestock sector

Participants identified a long list of best practices for climate action in the livestock sector. These practices contribute to the mitigation of GHG emissions, enhance adaptation and resilience of the sector to climate change thereby ensuring food security. Some examples are listed below:

- ▶ integrated crop–livestock systems (e.g. silvo–pastoral and agroforestry systems);
- ▶ improved manure management systems;
- ▶ producing renewable energy and recycle nutrients on farms and nearby croplands;
- ▶ restoration of degraded lands to enhance soil carbon sequestration;
- ▶ management of rangeland to prevent wildfire, pastoral conflicts, overgrazing;
- ▶ avoiding deforestation;
- ▶ improved livestock breeding for climate change adaptation;
- ▶ improved forage availability and storage;
- ▶ improved animal health, disease control and animal nutrition;
- ▶ sustainable value chain development;
- ▶ climate–smart livestock practices (projects, programmes).

9.2 Challenges and barriers for climate action in the livestock sector

Participants highlighted some common challenges and barriers as follows:

- ▶ limited farmers' awareness of the role of the livestock sector in climate change and carbon sequestration (its role as sink and source);
- ▶ limited farmers' capacity to access and implement new technologies and innovative solutions;
- ▶ insufficient technical capacity for Measurement, Reporting and Verification (MRV) of livestock emissions to track and demonstrate progress towards a mitigation targets;
- ▶ complexity of SOC accounting methods;
- ▶ availability of livestock data to perform baseline analysis and GHG inventories;
- ▶ limited or inadequate policies on livestock and climate change;
- ▶ insufficient institutional capacity to implement and coordinate policies across sectors;
- ▶ inadequate legal frameworks on land management, deforestation, stocking rates;
- ▶ lack of funding or inadequate national budget allocation towards the livestock sector;
- ▶ incompliance with requirements to access international climate finance (co-financing need);
- ▶ insufficient investment in the livestock sector;
- ▶ vulnerability of the sector and its natural resource base and the impact of a changing climate on livestock production, animal health, fertility, performance, socio-economic role for households and livelihoods;
- ▶ balance between adaptation and mitigation needs and achieving food security.

9.3 Key actions to improve livestock systems

Participants commonly identified several key actions to improve livestock systems and to implement climate action in the livestock sector. Actions need to be taken in the area of policies and institutions, capacity development, research and finance.

9.3.1 Policies, institutional and legal frameworks

- ▶ creation of an enabling environment to implement climate action in the livestock sector
- ▶ incorporating climate change in livestock development policies and planning, and developing national livestock improvement strategies;
- ▶ development/updating legal frameworks and policies to avoid deforestation, and regulate and control range- and grasslands stocking rates;
- ▶ national policies and programmes should consider the diversity of production systems and agro-ecological zones and be system-specific;
- ▶ need for multi-sector and multi-stakeholder approaches;
- ▶ regional coordination and alignment of regional policies for livestock climate action;
- ▶ adding livestock and climate change in university curricula and support training of trainers.

9.3.2 Technical capacity and awareness

- ▶ support awareness raising and capacity development on climate change and sustainable livestock production at all levels (e.g. producers, consumers, professionals and researchers);
- ▶ promote climate-smart and integrated farming practices and locally adoptable technologies through capacity development on the ground;
- ▶ more capacity development for data collection and analysis, GHG inventories, methods and metrics that capture the complexity of livestock systems, and further development of accounting tools as required for Measurement, Reporting and Verification (MRV) and the Enhanced Transparency Framework of the UNFCCC;
- ▶ development of national emission factors (Tier 2 methodology) to estimate livestock emissions;
- ▶ develop capacity to account for soil organic carbon stocks and sequestration.

9.3.3 Research needs

- ▶ improve the science and knowledge base to inform policymakers by promoting research on the mechanisms of climate change mitigation and adaptation;
- ▶ conduct analysis on the impacts of climate change on genetic resources, fertility, and productivity;
- ▶ assessment of rangeland and improvement of forage species;
- ▶ conduct climate change scenarios and socio-economic impact studies (i.e. cost-benefit analysis);
- ▶ research on long-term mitigation and adaptation scenarios;

9.3.4 Finance and investment

- ▶ formulation of integrated projects (with a more holistic approach) not only focusing on livestock production, but also considering socio-economic aspects related to resilience of livelihoods and the integration of cropping and forestry;
- ▶ development of sustainable value chains for livestock products and improvement of access to markets to support farmers' income;
- ▶ a better understanding of the extended co-benefits, as well as trade-offs from the sector to direct public investments and attract external sources of investments;
- ▶ identification of national long-term priorities to facilitate countries' access to climate finance.

10. Conclusions

The KJWA can play a crucial role in enabling the livestock sector to contribute to climate action by mobilizing knowledge, technology, finance and capacity.

Participants welcomed the workshop series as a good platform to exchange views and experience on national initiatives and practices for climate action in the livestock sector. They identified several challenges and barriers for livestock climate action and were able to identify key actions to improve livestock systems.

The workshop series also helped to increase general awareness of the KJWA process and roadmap, as only a few participants were actively involved in livestock and climate change activities as negotiators at the UNFCCC level. It was evident that the Koronivia process can support countries to address the challenges and barriers identified during this series of workshops.

The workshop reiterated the need to develop policies and strategies to support climate action in the livestock sector and highlighted the importance of climate financing, technology transfer and capacity development of farmers, extension services and government officials.

Through FAO's Strategy on Climate Change, the Organization is helping countries develop and implement new strategies for climate change adaptation and mitigation within the agriculture sector (FAO, 2021g). FAO also supports countries in the development and analysis of technical and policy options for climate change mitigation and adaptation actions in the livestock sector.

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Annex 1 - Workshop agenda

Day 1 – Boosting Koronivia in the livestock sector – Moderation: FAO

TIME (GMT+2)	PROGRAMME	PRESENTER
09:45 – 10:00	Opening of the virtual meeting room	Host (FAO)
10:00 – 10:30	Official opening <ul style="list-style-type: none"> Opening remarks Day 1 programme and objective 	FAO, Subregional Coordinator
	Overview of the Koronivia Joint Work on Agriculture (KJWA): outputs and roadmap	FAO, Office of Climate Change, Biodiversity and Environment
10:30 – 10:40	Overview and outlook of the regional Livestock sector	FAO, Subregional Office
10:40 – 10:50	Improvement of livestock systems management, topic 2(e)	Aimable Uwizeye, Livestock Policy Officer (FAO)
10:50 – 11:00	Options to reduce enteric methane in different livestock systems	Juliana Lopes, Livestock Production and Climate Change Specialist (FAO)
11:00 – 11:40	Breakout group discussions <ul style="list-style-type: none"> How to enable and upscale the contribution of different livestock systems to climate action? How can KJWA be used to enhance the livestock targets in the national climate actions? What are the key actions and priorities towards the improvement of livestock systems? 	Facilitators and participants
11:40 – 12:10	Plenary: restitution of the group discussions	Participants
12:10 – 12:35	Summary of the discussion	Moderator
12:35 – 12:45	Closing of the day	Host

Day 1 – Boosting Koronivia in the livestock sector – Moderation: FAO

TIME (GMT+2)	PROGRAMME	PRESENTER
09:45 – 10:00	Opening of the virtual meeting room	Host (FAO)
10:00 – 10:20	Official opening: Day 2 programme and objectives	FAO
10:20 – 10:40	Access to finance for climate action in the livestock sector: <ul style="list-style-type: none"> Examples of GEF and GCF financed projects 	Saskia Reppin, Livestock Systems and Koronivia Specialist (FAO)
10:40 – 11:30	Breakout group discussion <ul style="list-style-type: none"> What are the practices that can be implemented at country level to enhance carbon sequestration? What are the challenges and barriers to implement climate actions for the livestock sector at national level? What are the expectations and needs in terms of analysis of the livestock sector? 	Facilitators and participants
11:30 – 12:10	Plenary: restitution of the group discussions	Participants
12:10 – 12:35	Summary of the workshop discussion (1 + 2)	Moderator
12:35 – 12:45	Workshop closing remarks	FAO

Annex 2 - Workshop package

Boosting Koronivia in the Livestock sector Information packet

Livestock are key drivers for sustainable development in agriculture. They contribute to food security, nutrition, poverty alleviation, and economic growth. Through the adoption of best practices, the sector can reduce its environmental impacts and become more efficient in the use of resources.

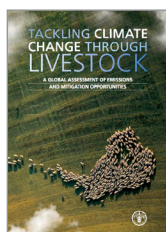
As part of achieving the 2030 Agenda for Sustainable Development and the Paris Agreement, the Food and Agriculture Organization of the United Nations (FAO) is committed to assist countries to approach zero hunger while tackling climate change through improved livestock systems management. The **Koronivia Joint Work on Agriculture (KJWA)** can play a crucial role in enabling the livestock sector to contribute to climate action by mobilizing knowledge, technology, finance and capacity. The KJWA acknowledges the strategic importance of livestock including key areas such as improved soil carbon sequestration in grazed grasslands, improved nutrient use and manure management and improved livestock management systems.

FAO SUBMISSIONS to the United Nations Framework Convention on Climate Change (UNFCCC) on:

Topic 2(e) – Improved livestock management systems, including agropastoral production systems and others. [www4.unfccc.int/sites/SubmissionsStaging/Documents/202004201455---FAO%20submission%20KJWA%202\(e\)_2\(f\)_final.doc.pdf](http://www4.unfccc.int/sites/SubmissionsStaging/Documents/202004201455---FAO%20submission%20KJWA%202(e)_2(f)_final.doc.pdf)

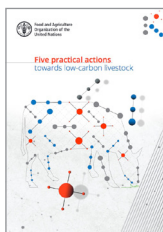
Topic 2(d) – Improved nutrient use and manure management towards sustainable and resilient agricultural systems. [www4.unfccc.int/sites/SubmissionsStaging/Documents/201909271709---FAO%20Submission%20on%20KJWA_2\(d\).pdf](http://www4.unfccc.int/sites/SubmissionsStaging/Documents/201909271709---FAO%20Submission%20on%20KJWA_2(d).pdf)

FAO PUBLICATIONS



TACKLING CLIMATE CHANGE THROUGH LIVESTOCK – A GLOBAL ASSESSMENT OF EMISSIONS AND MITIGATION OPPORTUNITIES

As renewed international efforts are needed to curb greenhouse gas emissions, the livestock sector can contribute its part. As an important emitter of greenhouse gas, it also has the potential to significantly reduce its emissions. This report provides a unique global assessment of the magnitude, the sources and pathways of emissions from different livestock production systems and supply chains. Relying on life cycle assessment, statistical analysis and scenario building, it also provides estimates of the sector's mitigation potential and identifies concrete options to reduce emissions. The report is a useful resource for stakeholders from livestock producers to policy-makers, researchers and civil society representatives, which also intends to inform the public debate on the role of livestock supply chains in climate change and possible solutions. Read more here: www.fao.org/publications/card/en/c/030a41a8-3e10-57d1-ae0c-86680a69ceea/



FIVE PRACTICAL ACTIONS TOWARDS LOW-CARBON LIVESTOCK

Action on climate change in livestock agri-food systems is an urgent priority, but must not come at the expense of other sustainability objectives, such as reducing hunger and poverty. Hence there is a need to balance the benefits of animal-source foods and livestock keeping, with the urgent need to reduce greenhouse gas emissions to tackle the climate crisis, which also threatens food security. The following five practical actions can be widely implemented

for measurable and rapid impacts on livestock emissions: 1) boosting efficiency of livestock production and resource use; 2) intensifying recycling efforts and minimizing losses for a circular bioeconomy; 3) capitalizing on nature-based solutions to ramp up carbon offsets; 4) striving for healthy, sustainable diets and accounting for protein alternatives; and 5) developing policy measures to drive change. This brief describes how these can be implemented in integrative and sustainable ways, taking account the diversity of livestock systems and enhancing synergies and managing trade-offs with other sustainable development objectives.

Read more here: www.fao.org/publications/card/en/c/CA7089EN/

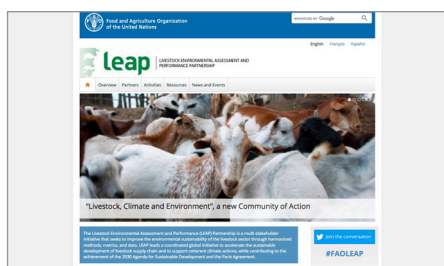


SHAPING THE FUTURE OF LIVESTOCK SUSTAINABLY, RESPONSIBLY, EFFICIENTLY

Livestock are terrestrial, domesticated animals raised in an agricultural setting to provide traction or produce commodities such as meat, milk, eggs and hides. They contribute to diverse agri-food systems globally, playing many roles for different groups of people. From the perspective of the sustainability of the global livestock sector, there are four important and interrelated aspects: food and nutrition security; livelihoods and growth; health and animal welfare; and climate and natural resource use. Sustainable livestock are at the interface of

these four topics. This brochure was prepared by FAO to help guide discussions during the 10th Global Forum for Food and Agriculture. Access the publication here: www.fao.org/publications/card/en/c/I8384EN

OTHER RESOURCES



THE LIVESTOCK ENVIRONMENTAL ASSESSMENT AND PERFORMANCE (FAO LEAP) PARTNERSHIP

is a multi-stakeholder initiative that seeks to improve the environmental sustainability of the livestock sector through the development of guidance and harmonized methods, metrics, and data. FAO LEAP leads a coordinated global initiative to stimulate climate action and accelerate environmental improvement of feed and livestock production systems, thus contributing to the objectives of the 2030 Agenda for Sustainable Development and the Paris Agreement. FAO LEAP is currently working on the application of its guidelines to identify better production practices to address the following challenges: climate change, water use, soil organic carbon, nutrient use efficiency, and impact on biodiversity.

Read more here: www.fao.org/partnerships/leap/en/



THE GLOBAL LIVESTOCK ENVIRONMENTAL ASSESSMENT MODEL (GLEAM)

is a geographically explicit modelling framework that simulates the interaction of activities and processes involved in livestock production and the environment using a life cycle assessment approach. The model can operate at (sub) national, regional and global scale. The aim of GLEAM is to quantify production and use of natural resources in the livestock sector and to identify environmental impacts of livestock in order to contribute to the assessment of adaptation and mitigation scenarios to move towards a more sustainable livestock sector.

Read more here: www.fao.org/gleam/en/



THE GLOBAL AGENDA FOR SUSTAINABLE LIVESTOCK (GASL) is a multi-stakeholder partnership (MSP) established in 2011, with more than 110 institutional partners and thousands of stakeholders around the world. It is a recognized platform for sharing good practices and policies, and promotes the sustainability of the global livestock sector. Its main principle is that all livestock production systems can be more sustainable, no matter where they are. The main objectives of the Global Agenda are to facilitate dialogue, assemble and communicate evidence and foster practice and policy change.

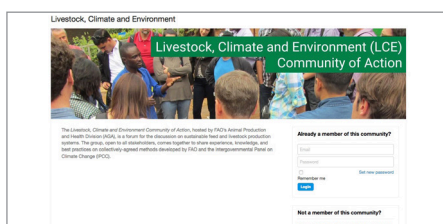
Read the GASL fact sheet here: www.livestockdialogue.org/fileadmin/templates/res_livestock/docs/About_Agenda/GASL_Factsheet.pdf

Access the GASL website here: www.livestockdialogue.org/



“REDUCING ENTERIC METHANE FOR IMPROVING FOOD SECURITY AND LIVELIHOODS” is a collaboration between FAO and the New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC). The project aims to support low- and middle-income countries to identify system-specific technologies and interventions to increase livestock productivity, food security and reduce enteric methane emissions per unit of product. The project also seeks to provide guidance to decision-makers with recommendations on incentives and institutional frameworks necessary to incentivize adoption of productivity-enhancing technologies and practices.

Read more here: www.fao.org/in-action/enteric-methane/en/



THE LIVESTOCK, CLIMATE AND ENVIRONMENT COMMUNITY OF ACTION, hosted by FAO's Animal Production and Health Division, is a forum for the discussion on sustainable feed and livestock production systems. The group, open to all stakeholders, comes together to share experience, knowledge, and best practices on collectively-agreed methods developed by FAO and the Intergovernmental Panel on Climate Change (IPCC). Access the Community of Action here: <https://dgroups.org/fao/lce-community>



NITROGEN EMISSIONS ALONG GLOBAL LIVESTOCK SUPPLY CHAINS.

Global livestock supply chains have significantly altered nitrogen (N) flows over past years, thereby threatening environmental and human health. This study provides a disaggregated assessment of the livestock sector's impacts on global N flows and emissions, including international trade. The results show that the sector currently emits 65 Tg N yr⁻¹, equivalent to one-third of current human-induced N emissions and sufficient to meet the planetary boundary for N. Of that amount, 66 percent is allocated to Asia and 68 percent is associated with feed production. Most emissions originate from locally produced animal-sourced food, although N emissions embedded in international trade are significant for some importing countries. Given the magnitude of its impacts and its central role in both domestic and international N challenges, the livestock sector urgently requires a global initiative to tackle N pollution while supporting food security.

Uwizeye, A., de Boer, I.J.M., Opio, C.I. *et al.* Nitrogen emissions along global livestock supply chains. *Nat Food* 1, 437–446 (2020). <https://doi.org/10.1038/s43016-020-0113-y>

Visit our website for more information and updates
www.fao.org/livestock-environment/en/

Annex 3 - List of participants

Table A.1. Workshop participants from all regions

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<p>Kleber Souza dos Santos Federal Agricultural Inspector Social and Environmental Affairs Advisory Minister's Office Ministry of Agriculture, Livestock and Food Supply (MAPA) Esplanada dos Ministérios Bloco D, Brasília, DF, 70632-100, Brazil</p>	

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<p>Nana Thérèse Roseline S. Conseiller Technique Ministère des Ressources Animales et Halieutiques (MRAH) Paspanga, Ouagadougou Kadiogo, Burkina Faso</p>	<p>Pamoussa Ouedraogo Directeur Général de l'Economie Verte et du Changement Climatique Ministère de l'Environnement, de l'Economie Verte et du Changement Climatique 03 BP 7044 Ouagadougou Kadiogo, Burkina Faso</p>
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Juan Mancebo Ministerio de Agricultura Autopista Duarte KM 6 ½ Los Jardines del Norte. Santo Domingo, D.N. República Dominicana	
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Mali	
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Mexico	
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La Molina, Provincia de Lima, Peru

Blg. Gary Pascual
Coordinador del Área de Cambio Climático
Ministerio de Desarrollo Agrario y Riego
Alameda del Corregidor 155
La Molina, Provincia de Lima, Peru

Ing. Jorge Vasquez
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Baba Soumare (FAORAF)	Ghana
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Etienne Drieux (OCB)	HQ
Eva Bravo (SLM)	Panama
Felipe Chamizo (RLC)	Chile
Fiona Bottiglieri (OCB)	HQ
Gabriel Teno (NSAL)	HQ
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Cont.

Cont.

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Rutendo Tinarwo (FAOSFS)	Zimbabwe
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Tezeta Hailemeskel (FAOSFE)	Kenya
Timothy Robinson (NSAL)	HQ
Ugo Pica Ciamarra (NSAL)	HQ

Annex 4 - Results of workshop polls

Figure A.1. Response profile from all regions

Which of the Koronivia topics are most closely in line with your expertise and background?

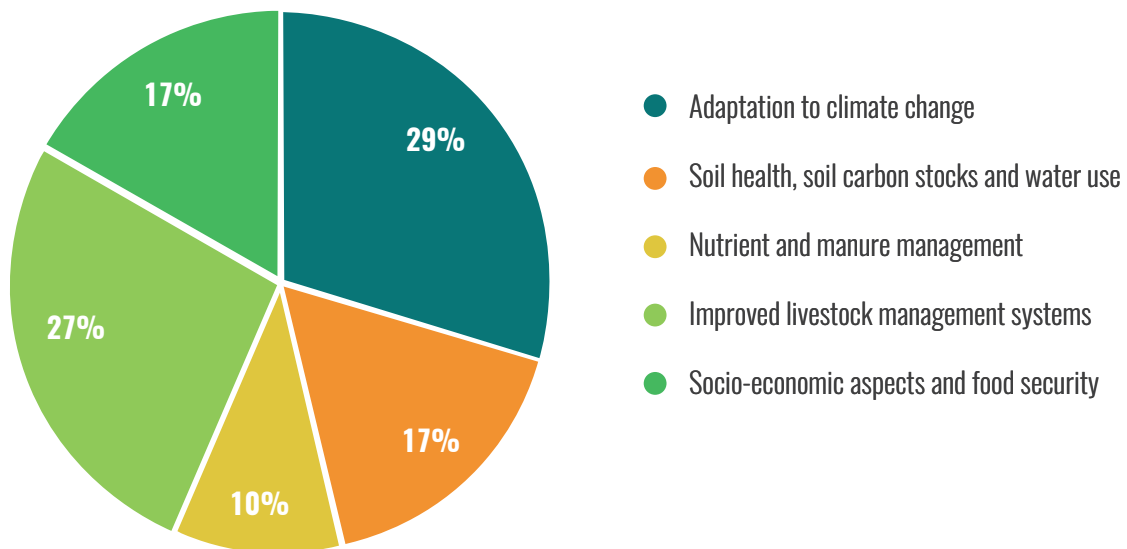


Figure A.2. Response profile disaggregated by region

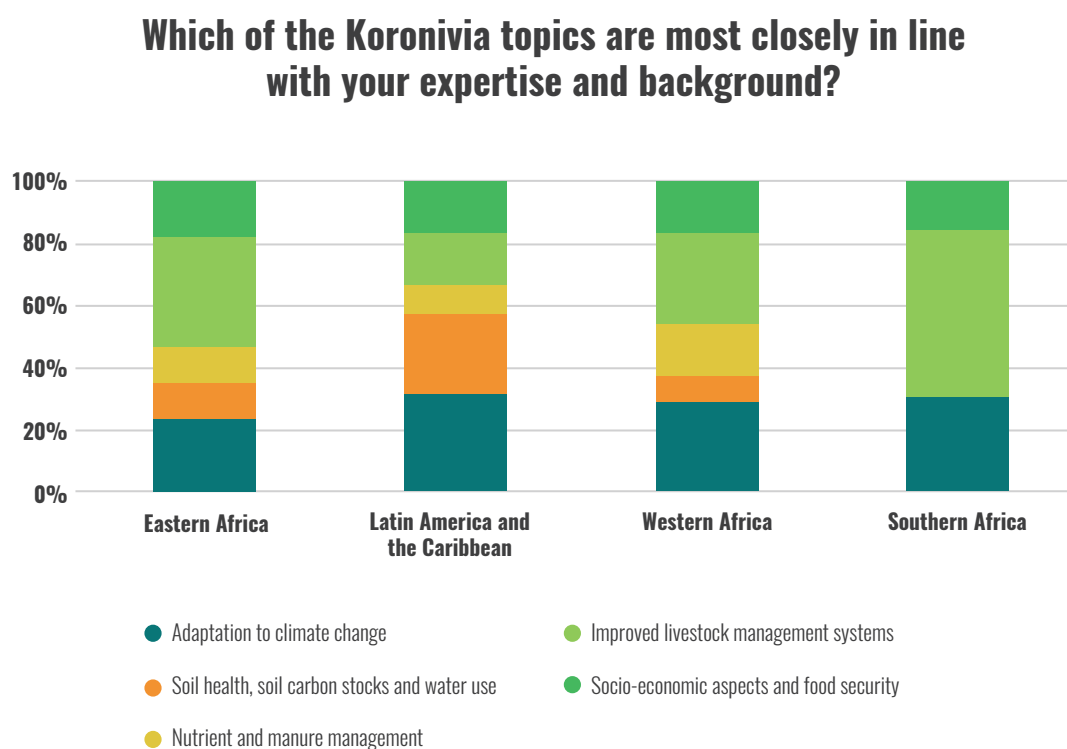
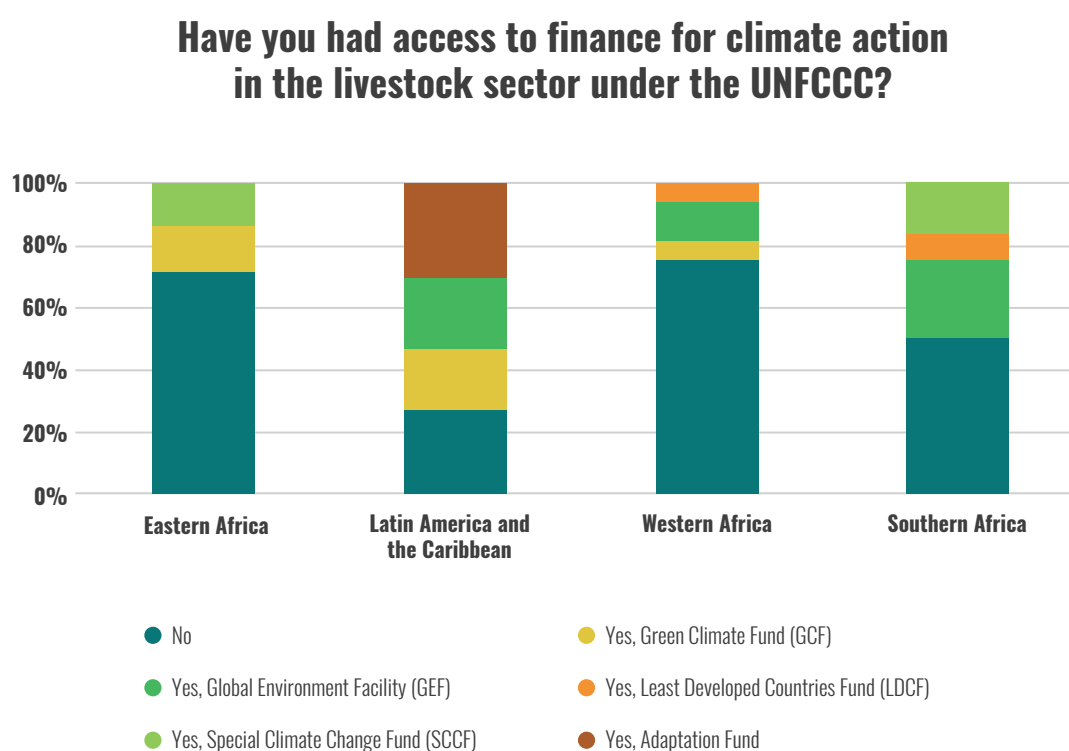
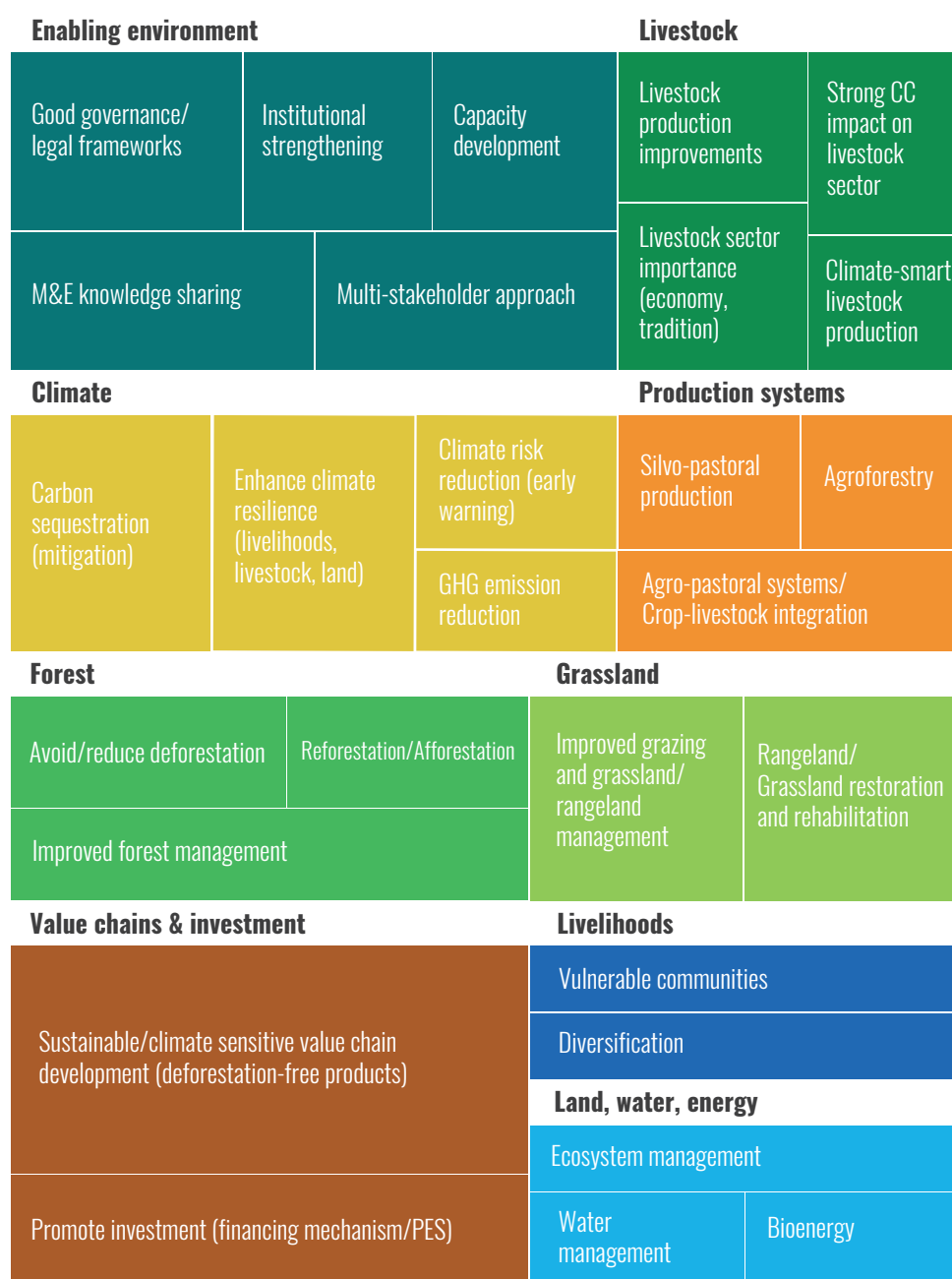


Figure A.3. Response profile disaggregated by region



Annex 5 - Global Environment Facility and Green Climate Fund project analysis results

Figure A.4: Visualization of importance of project components and elements based on analysis of 12 GEF and GCF projects.



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ISBN 978-92-5-134276-3



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CB4348EN/1/04.21