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Reducing methane emissions in livestock systems in Asia and the Pacific

Enhancing national climate actions through the Global Methane Pledge

Workshop report
Bangkok, Thailand
24–26 October 2022

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The workshop was part of a series of regional consultations on “Enhancing national climate actions on methane in the livestock sector”, implemented in the third phase of the project “Reducing enteric methane for improving food security and livelihoods”, entitled “Creating the enabling environment for enhanced climate ambition and climate action through institutional capacity building” (EP/INT/431/UEP).

This workshop also contributed to the project “Supporting the Koronivia Joint Work on Agriculture: Enhanced capacities and knowledge-sharing opportunities of developing countries on agricultural solutions to address climate change” (KJWA-Plus; GCP/GLO/992/JPN).

The organization of the workshop was led by an FAO team composed of Aimable Uwizeye, Saskia Reppin, Akiko Nagano, Sonevilay Nampany, Beau Damen and Bo Zhou. Overall guidance and support have been provided by Jong-Jin Kim, Assistant Director-General, Regional Office for Asia and the Pacific, Thanawat Tiensin, Director Animal Production and Health Division, Martial Bernoux, and Tim Robinson.

END MATTER

This workshop contributed to the work of FAO to address methane emissions in the livestock sector in collaboration with CCAC, under the overall guidance of Jong-Jin Kim, Assistant Director-General of FAO Regional Office for Asia and the Pacific (RAP), and Thanawat Tiensin, Director of the FAO Animal Production and Health Division. Martial Bernoux and Tim Robinson provided support to the organizing team.

Aimable Uwizeye and Saskia Reppin prepared this report, with the contribution of Monica Rulli, Akiko Nagano, Sonevilay Nampanya and Beau Damen. The authors would like to thank Imelda Bacudo (Association of Southeast Asian Nations - Climate Resilience Network [ASEAN-CRN]), Martina Otto (CCAC), Catalina Etcheverry (CCAC), Claire Henly (White House Fellow detailed to the United States Special Presidential Envoy for Climate John Kerry), Frank Mitloehner

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Abbreviations and acronyms

AFOLU	agriculture, forestry and other land use
APHCA	Animal Production and Health Commission for Asia and the Pacific
ASEAN-CRN	Association of Southeast Asian Nations – Climate Resilience Network
CCAC	Climate and Clean Air Coalition
CLEAR	Clarity and Leadership for Environmental Awareness and Research
CNSL	cashew nut shell liquid
COP26	2021 United Nations Conference on Climate Change
CSL	climate-smart livestock
FAO	Food and Agriculture Organization of the United Nations
FAO RAP	FAO Regional Office for Asia and the Pacific
GCF	Green Climate Fund
GDP	gross domestic product
GHG	greenhouse gas
GMP	Global Methane Pledge
IPCC	Intergovernmental Panel on Climate Change
IPSARD	Institute of Policy and Strategy for Agriculture and Rural Development
JIRCAS	Japan International Research Center for Agricultural Sciences
KMUTT	King Mongkut’s University of Technology Thonburi
MAFF	Ministry of Agriculture, Forestry and Fisheries
MRV	measurement, reporting and verification
NAP	National Adaptation Plan
NDC	nationally determined contribution
NZAGRC	New Zealand Agricultural Greenhouse Gas Research Centre
SDG	Sustainable Development Goal
SLCP	short-lived climate pollutant
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

CHEMICAL ELEMENTS, FORMULAE AND UNITS

°C	Degrees Celsius
CO₂-eq	carbon dioxide equivalent
Gt	gigatonne, metric unit equivalent to 1 billion (10 ⁹) tonnes
Mt	megatonne, metric unit equivalent to 1 million (10 ⁶) tonnes

Executive summary

This report discusses the outcomes of a regional expert workshop aimed at enhancing national climate actions on methane in the livestock sector in Asia and the Pacific in the context of the Global Methane Pledge. Over two-thirds of Asian countries, and one-quarter of Pacific countries, have included one or more livestock mitigation measures in their latest nationally determined contributions (NDCs), recognizing the contributions of the livestock sector towards low-emission reductions.

The workshop aimed to raise awareness and provide information on livestock production and development, methane emissions, and mitigation options from livestock systems, and to identify pathways for enhancing livestock climate actions through methane mitigation. The participants shared their experiences regarding national livestock climate action priorities, and discussed challenges and opportunities to implement methane mitigation interventions in livestock systems on the ground.

The workshop highlighted the urgent need to reduce absolute greenhouse gas emissions, particularly methane which is a short-lived climate pollutant, and explored different pathways to implement and scale up methane reduction solutions, with a focus on long-term investment in research and development. The report includes key recommendations to immediately upscale existing best practices and policies on animal health and production, genetics and breeding management, manure management systems, and feeding, to reduce methane emissions.

Moreover, policy options for addressing methane emissions were discussed, and a system of taxation and reinvestment in research and development was seen as applicable in countries with a strong and developed private sector. Finally, the report recognizes the importance of collaborating with all stakeholders, including government agencies, the private sector and other non-states entities, to address climate change, and identifies opportunities for international cooperation and access to funding, in particular through the Climate and Clean Air Coalition, Green Climate Fund, Global Environment Facility, and other international financial institutions.

Introduction

CONTEXT

The livestock sector in Asia and the Pacific is facing new challenges due to population growth and climate change. To address these challenges, climate-smart livestock (CSL) strategies are needed, such as efficient natural resource use and increased livestock productivity, which can support poverty reduction, enhance food security, and contribute to climate mitigation and resilience (Food and Agriculture Organization of the United Nations [FAO], 2021). The livestock sector, however, is also a significant contributor to greenhouse gas (GHG) emissions, responsible for about 14.5 percent of total GHG emissions, mostly in the form of methane. Reducing methane emissions from all sectors, including livestock, can help prevent global warming and keep the global average temperature increase below 1.5 °C, which is crucial to avoid climate crises (CCAC and United Nations Environment Programme [UNEP], 2021).

To recognize the contributions of the livestock sector towards low-emission reductions in NDCs, over two-thirds of Asian countries and one-quarter of Pacific countries have included one or more livestock mitigation measures in their latest NDCs. Moreover, many countries in the region have signed the Global Methane Pledge (GMP), a voluntary initiative launched at the 2021 United Nations Conference on Climate Change (COP26) by the United States of America and the European Union. The initiative aims to reduce global methane emissions from 2020 levels by 30 percent or more by 2030. Reducing methane emissions requires regional collaboration to exchange knowledge and identify opportunities for developing joint activities towards a sustainable livestock sector.

ABOUT THE WORKSHOP

To support a sustainable livestock sector in Asia and the Pacific, FAO implemented a project funded by the Climate and Clean Air Coalition (CCAC) in collaboration with Global Research Alliance on Agricultural Greenhouse Gases (GRA), New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC) and other partners. This workshop, organized in collaboration with the Animal Production and Health Commission for Asia and the Pacific (APHCA), was part of a series of regional consultations aimed at enhancing national climate actions on methane in the livestock sector. The workshop aligns with FAO's strategic programme on a better environment and better production, focusing on combating climate change, promoting sustainable agriculture production, and ensuring sustainable consumption and production patterns. It also aligns with FAO strategy on climate change and FAO strategy on science and innovation.

Objectives and structure

The regional expert workshop aimed to support countries in strengthening climate actions and identifying opportunities to address methane in the livestock sector in the context of the GMP.

The specific objectives of the workshop were to:

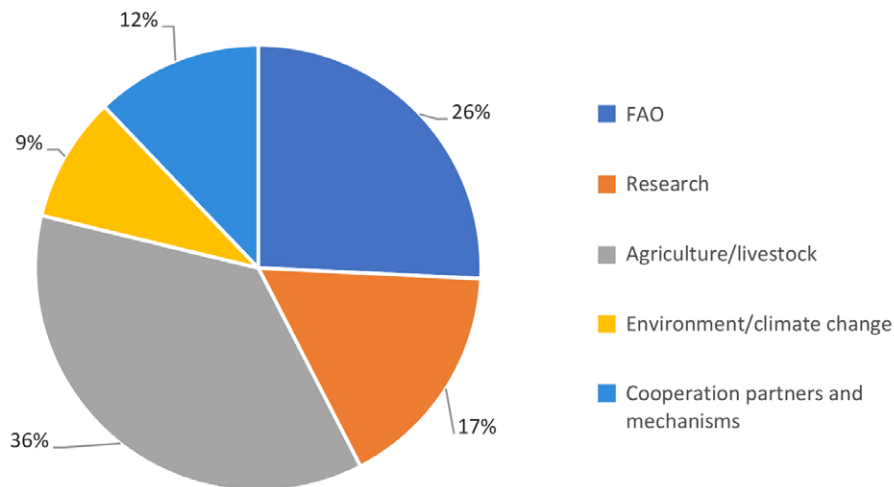
- raise awareness and provide information on livestock development, methane emissions and mitigation options from livestock systems, and explore opportunities in the context of the GMP;
- exchange countries' experience regarding national livestock climate action priorities and discuss challenges and opportunities to implement methane mitigation interventions in livestock systems on the ground;
- share countries' experience and expertise on innovation, technologies and good practices for methane mitigation in livestock systems; and
- identify pathways for enhancing livestock climate actions through methane mitigation, including solutions in technical mitigation approaches, policy interventions, access to finance, or discussion of “no action” and integration of livestock into national climate actions.



Participants of the workshop “Enhancing national climate actions to reduce methane emissions in livestock systems in Asia and the Pacific in the context of the Global Methane Pledge” met at the Pullman Hotel G, Bangkok, from 24 to 26 October 2022. All photos taken in Bangkok, Thailand.

Workshop participants

A total of 68 participants attended the workshop, including speakers, facilitators and remote participants, from 18 countries in Asia and the Pacific. Figure 1 shows the clusters of participants based on their domains of work. The workshop was facilitated and moderated by staff from FAO headquarters and the FAO Regional Office for Asia and the Pacific. The list of participants can be found in Annex 3.

Figure 1. Distribution of participants by institutions and domains

Source: Elaborated by the authors.

Invitations to attend the workshop were sent to APHCA and countries in the region, including Australia, Bangladesh, Bhutan, Cambodia, China, Fiji, India, Indonesia, Islamic Republic of Iran, Japan, Lao People’s Democratic Republic, Malaysia, Mongolia, Nepal, New Zealand, Pakistan, Papua New Guinea, Philippines, Republic of Korea, Samoa, Singapore, Sri Lanka, Thailand and Viet Nam. The event was supported by the Association of Southeast Asian Nations–Climate Resilience Network (ASEAN-CRN), known for facilitating climate-smart agriculture dialogue in the region. Delegates from national ministries (of agriculture and livestock, and of the environment), including climate-change focal points, livestock specialists, inventory compilers, and other livestock and climate-change policy officers, represented each country. The agenda of the workshop is provided in Annex 1.



Left to right: Sonevilay Nampanya, Livestock Development Officer at FAO RAP; Scott Newman, Senior Animal Health and Production Officer, FAO RAP; Wacharapon Cbotiyaputta, Director of the Division of International Livestock Cooperation, Ministry of Agriculture and Cooperatives of Thailand; and Aimable Uwizeye, Livestock Policy Officer, FAO.

Workshop proceedings

Participants completed a pre-workshop survey on national initiatives to support climate action in the livestock sector. The workshop included presentations on livestock and climate change, and provided a platform for sharing national experiences. Discussions focused on integrating methane mitigation interventions into national climate actions; research and innovative and technological solutions; and exploring policy solutions to reduce methane in livestock systems. The participants also discussed key actions and policies for reducing methane from livestock systems.

RESULTS OF THE PRE-WORKSHOP SURVEY

Presented by Saskia Reppin, Livestock and Climate Change Specialist (Policy), FAO

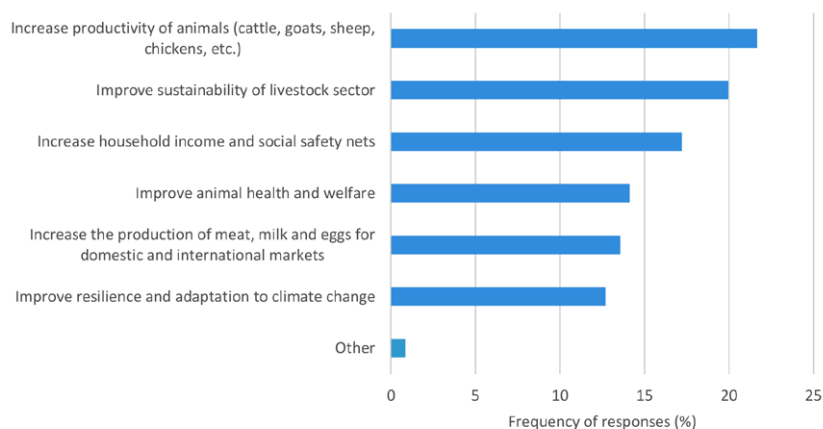
Before the workshop, a survey was conducted to gather information on the participants' expertise, knowledge, and expectations for the event. The survey received 28 responses from 16 countries, and the respondents' primary expertise included livestock development, climate-change mitigation, GHG emission inventory and policy development, making them all a good fit for the workshop. The survey also provided insights into the status of livestock integration in national climate actions and NDCs.

The survey revealed that livestock sector development objectives are not always aligned with climate objectives, but it is important not to overlook them when integrating livestock into national climate actions. Respondents reported that their countries' primary goals for the livestock sector were to increase productivity, improve sustainability, and increase household income and social safety nets (Figure 2). Fewer respondents chose improving resilience and adaptation to climate change as the sector's main objective. The objectives related to climate-change adaptation and mitigation, such as improved livestock and herd management, and animal health, moreover, were the most commonly included in livestock development policies or strategies. Carbon sequestration, natural resource management and grassland rehabilitation were less commonly mentioned (Figure 3).

Over 80 percent of respondents reported that their country's NDC addressed livestock, and most National Adaptation Plans (NAPs) and national climate-change policies or strategies included livestock. Only a few mentioned that their countries also included livestock in low-carbon and climate resilience strategies, Nationally Appropriate Mitigation Actions, national decarbonization plans, and other policy documents. Livestock was typically included in NDCs as commitments to specific mitigation or adaptation measures, or as part of GHG reduction targets. Respondents identified the public sector, non-governmental organizations, research and academia as the main actors involved in implementing NDC commitments. For GHG inventories, research and academia were the primary actors involved, with agriculture and livestock census and private sector databases being the main sources of activity data. However, over one-third of respondents were unsure about the methodology used for their national GHG inventory, while others reported using tier 1 or tier 2.

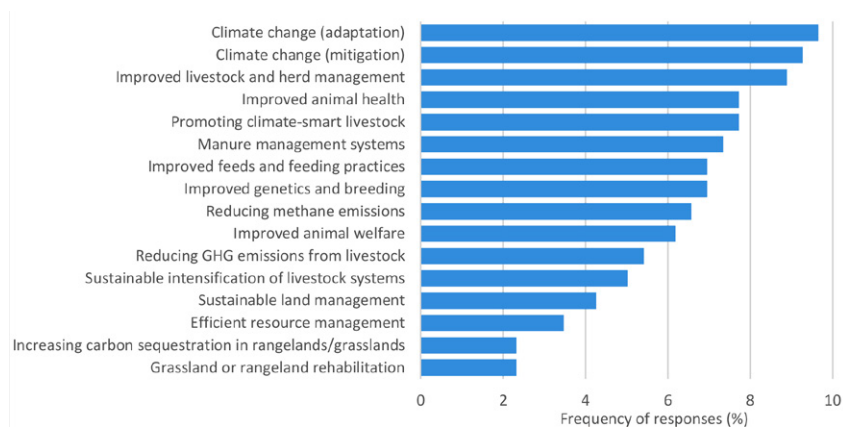
Respondents' institutions prioritized research on improving feeding practices, manure management, enteric methane, feed additives and biogas production over improved grassland and rangeland management.

Figure 2. Percentage of response on countries' primary goals for the livestock sector



Source: Elaborated by the authors.

Figure 3. Percentage of responses on the objectives related to climate change included in the livestock development policies or strategies



Source: Elaborated by the authors.



Saskia Reppin, Livestock and Climate Change Specialist at FAO, facilitates a group discussion during the workshop.

OPENING SESSION

The opening remarks were provided by representatives of FAO, ASEAN-CRN, CCAC and the Ministry of Agriculture, Forests and Fisheries (MAFF) of Japan. The workshop was officially opened by the representative of the Ministry of Agriculture and Cooperatives of Thailand. The opening session was moderated by Sonevilay Nampanya, Livestock Development Officer, FAO. The following are the key points highlighted in their speeches.

- Scott Newman, *Senior Animal Health and Production Officer, FAO*, welcomed participants to the workshop in this diverse region, home to 60 percent of the world's population. He highlighted the wide range of livestock systems present, from small-scale and medium-scale to highly industrialized, and emphasized the challenges of addressing climate actions in the livestock sector in light of the expected economic growth in the region. CSL practices can help tackle this challenge, and he encouraged participants to discuss needs and challenges over the three-day workshop.
- Imelda Bacudo, *Coordinator and Adviser to ASEAN-CRN*, emphasized the importance of the workshop for the network members and the region, given its focus on climate-smart agriculture. She welcomed the opportunity to share regional examples and expressed hope that the workshop's outcomes would help draft strategic plans and support the implementation of climate-smart approaches in agrifood systems.
- Martina Otto, *Head of the CCAC Secretariat at UNEP*, emphasized the importance of this workshop's topic due to the food crisis and the triple environment crisis with climate, pollution, and nature. She warned that continuing current production and consumption patterns would worsen these crises, while population growth and climate change already harm food systems. The CCAC supports countries in reducing SLCPs such as methane, which is a fast and effective strategy to reduce global warming. The GMP has political momentum, with 15 countries in the region already signing the pledge. This workshop offers momentum to bring these measures to scale.
- Gen Kunieda, *Director of the Global Environmental Affairs Office of MAFF of Japan*, emphasized the importance of research and development for methane reduction options. He stated that livestock systems are complex and require technological and innovative solutions that may come with high costs and adaptation constraints. He highlighted the need for more regional and international collaboration to find country- and production-specific solutions to reduce GHG emissions from the livestock sector, as there is no one-size-fits-all solution.
- Wacharapon Chotiyaputta, *Director of the Division of International Livestock Cooperation at the Ministry of Agriculture and Cooperatives of Thailand*, emphasized the critical importance of methane as the fastest-growing GHG in the atmosphere, for which humans are responsible for about two-thirds of emissions. In Thailand, 65 percent of agricultural emissions are methane, with 15 percent coming from the livestock sector (manure and enteric). Thailand aims to reduce GHG emissions by 30 to 40 percent by 2030, and implement measures such as biogas waste management and animal nutrition development in the livestock sector to meet this goal, which is aligned with its long-term low-emission development strategy. Wacharapon thanked FAO and partners

for organizing the workshop and welcomed all participants, hoping for rich and lively discussions to enhance national climate actions to reduce methane emissions in livestock systems in the Asia-Pacific region within the context of the GMP. He also thanked the participants for being ready to share their experiences and ideas, and wished all a successful workshop.



Sonevilay Nampanya, Livestock Development Officer, FAO RAP, moderates the opening session of the workshop.



Participants exchange ideas and best practices during the workshop.

GLOBAL METHANE EMISSIONS AND CLIMATE ACTIONS IN LIVESTOCK SYSTEMS

The global and regional perspective of livestock production: Development trends and challenges

Presented by Scott Newman, Senior Animal Health and Production Officer, FAO

FAO's global mandate is to improve food and nutrition security, increase agricultural productivity and growth, raise the standard of living for rural populations, and contribute to global economic development. FAO supports countries in the

transformation to more efficient, inclusive, resilient and sustainable agrifood systems, leaving no one behind. Food security exists when populations have access on an ongoing basis to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Livestock plays a crucial role in helping countries achieve food security, well-being, and economic stability of households.

Global meat production is projected to increase by 19 percent in 2030 compared to the 2015–2017 base period, with developing countries expected to account for almost the entire increase. Meanwhile, the largest producers – Brazil, China, the European Union and the United States of America – will continue to dominate meat production worldwide. The “livestock revolution”, which refers to the significant increase in demand for livestock products in developing countries, presents opportunities for increased livestock income through improved productivity and trade, alleviation of rural poverty, improved regional food and nutrition security, and development of the entire livestock sector, including pigs and poultry in countries such as Thailand, Viet Nam and China, for both domestic and international markets.

Some challenges come with a growing livestock sector in the region, including the degradation of water and land resources, nitrogen pollution, loss of biodiversity, and increased antimicrobial use. The livestock sector is also a major contributor to climate change, generating significant emissions of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). Methane, derived from enteric fermentation and manure management, accounts for the main share of GHG emissions. Livestock contributes about 32 percent of human-induced methane emissions globally.

CSL solutions can reduce GHG emissions through improved livestock productivity, efficient use of natural resources, carbon sequestration, and livestock integration into the circular bioeconomy. Rather than viewing the sector as part of the problem, the livestock sector can be part of the solution. Livestock productivity can be enhanced by increasing the output (e.g. increased milk production) or by decreasing inputs while maintaining the same output, for example, by using higher-quality feed rations. It is estimated that improving livestock productivity will reduce emissions per unit of livestock product by 20 to 30 percent.



Scott Newman, Senior Animal Health and Production Officer, FAO RAP, presents trend and challenges of livestock production in Asia and the Pacific.

Sustainable livestock development is crucial for addressing food and nutrition security, supporting livelihoods, and reducing poverty. Livestock farmers and feed producers must ensure the quality and safety of their products. Good livestock husbandry and feeding practices aimed at reducing antimicrobial use and enhancing animal welfare are essential as the demand for livestock-based protein increases. CSL and agroecological and sustainable practices can mitigate the impacts of climate change and prevent further environmental degradation, including biodiversity loss. Integrating crop, livestock, forest and aquatic biodiversity can promote resilience, improve livelihoods, and support food and nutrition security. Maintaining animal genetic resources and agricultural biodiversity is crucial for optimal adaptation to a changing climate. Food systems transformation, in line with the United Nations Food System Summit, requires leveraging food systems capacity to attain the Sustainable Development Goals (SDGs). Sustainable, climate-smart, eco-friendly livestock development is a significant transformation needed to provide healthy, abundant and safe food, and contribute to a better life in the Asia-Pacific region.

Overview of livestock and climate change

Presented by Aimable Uwizeye, Livestock Policy Officer, FAO

Global net anthropogenic GHG emissions are around 59 Gt CO₂-eq (Intergovernmental Panel on Climate Change [IPCC], 2022a). Regarding annual emissions, countries with the highest population emit the most. However, when looking at accumulated emissions over the last century, North America and Europe have the highest emission contributions. It is unequivocal that human influence has warmed the atmosphere in the last century, and the global net anthropogenic emissions have continued to rise across all GHGs, including methane and N₂O, which are significant for the agriculture sector. It is essential to know precisely how these emissions occur, how to measure them, and how to reduce them without undermining food security, nutrition and the livelihoods of the rural population. Livestock supply chains contribute around 8 Gt CO₂-eq, about 14.5 percent of total emissions. Concerning livestock species, most emissions come from ruminants. More than 50 percent are from enteric methane, while monogastric methane emissions are mainly from manure.

In 2015, countries signed the Paris Agreement, agreeing to limit the global temperature increase to below 2 °C compared to pre-industrial levels, and preferably to 1.5 °C. Projections indicate that the global surface temperature will continue to rise until at least mid-century under all emission scenarios considered. Without significant reductions in CO₂ and other GHG emissions in the coming decades, the global warming target will be exceeded in the twenty-first century. Proper mitigation interventions can help keep the temperature increase below the Paris Agreement goal. According to the IPCC report Global warming of 1.5°C, improved livestock and grazing land management are response options with a high to moderate positive impact potential on mitigation, adaptation, combating desertification and land degradation, and enhancing food security (IPCC, 2018). However, these improvements come with high costs, and farmers need incentives to change. While countries have committed to reducing GHG emissions through their NDCs, governments need to increase their climate ambitions, as current commitments are not sufficient to keep the global average temperature increase below 2 °C. In updated NDCs, mitigation contributions and adaptation components for the agricultural sector, particularly for livestock, have higher coverage than previous NDCs. Reducing methane in agriculture has synergies with achieving the SDGs (IPCC, 2022b).



Aimable Uwizeye, Livestock Policy Officer, FAO, gives a presentation on livestock, methane and climate change.

There is a need for climate-smart investments in the livestock sector, which contributes almost half of all agriculture emissions. However, only two percent of the total global climate investments in agriculture are directed towards livestock. The World Bank has identified several investment opportunities that can drive the sector's sustainable transformation with climate finance (World Bank, 2021). While this workshop strongly focuses on methane emissions because of significant opportunities in the livestock sector to reduce them, we must not forget the importance of reducing CO₂ emissions globally in tackling climate change.

Global Methane Pledge and livestock

Presented by Claire Henly, Energy Technology and Policy Expert, White House Fellow detailed to the United States Special Presidential Envoy for Climate John Kerry

Reducing methane is beneficial for climate, human, and environmental health. Methane has contributed to half a degree of the net 1.1 °C of warming experienced so far. It is a significant climate forcer but often does not receive the same attention as CO₂. To achieve the 1.5 °C pathway, we must reduce methane by at least 30 percent. However, in reality, methane emissions continue to increase. The Asia-Pacific region is the largest contributor to global methane emissions, with agriculture methane emissions in the region accounting for 42 percent of global emissions. Livestock methane emissions from the region contribute to 35 percent of total livestock methane emissions, according to the Global methane assessment report (UNEP and CCAC, 2022).

Finance is crucial to unlocking methane reductions; however, currently, only 2 percent of total climate finance targets methane abatement (Rosane *et al.*, 2022). Climate finance should match its net emission reduction potential. While overall climate finance is growing, agriculture mitigation finance has stagnated since 2018.

The GMP, launched at COP26 by the United States of America and the European Union, aims to reduce methane emissions by 30 percent by 2030 from 2020 levels. Over 150 countries – representing roughly 50 percent of global methane emissions and over 70 percent of the world's economy – have pledged to take domestic action on methane and move towards using higher-tier United Nations Framework Convention on Climate Change (UNFCCC) inventory methodologies.

Introduction to the Global Methane Hub

Presented by Hayden Montgomery, Programme Director Agriculture, Global Methane Hub

The Global Methane Hub, hereinafter referred to as “the Hub”, has been funded by leading philanthropic organizations committed to reducing methane emissions, totalling over USD 328 million. This capital was committed directly after the launch of the GMP to fast-track implementation. The Hub’s focus is on the energy, agriculture and waste sectors, which account for approximately 96 percent of human-caused methane emissions. Its approach is to catalyse investments, lay the groundwork for the long-term transformation of challenging sectors, and deliver quick wins in industries ready for action. The Hub aims to collaborate with governmental and non-governmental entities to scale up cost-effective solutions in methane mitigation and contribute to transformational change.

The mission of the Hub is to reduce anthropogenic methane emissions at their source. Emissions from wild animals are not anthropogenic. Agriculture accounts for 40 percent of total methane emissions. The agricultural sector’s context is complex, and several issues must be considered, as agricultural methane is caused by microbes in animals and soils, and is part of complex biological processes. Unlike emissions from other sectors, about 80 percent of agricultural methane emissions are emitted by low-and middle-income countries.

While the Hub focuses on reducing methane emissions, it is essential to ensure that other GHG emissions, such as N₂O and CO₂, do not increase. Another element of the Hub’s “do-no-harm” approach is being sensitive to food security needs, not undermining resilience and adaptation, and guaranteeing a just rural transformation. Over 2 billion people depend directly on livestock and rice cultivation, 750 million people are undernourished, and 3.1 billion cannot afford a healthy diet.

Cost-effective and proven agricultural methane mitigation technologies for absolute reductions are mostly lacking. Although some do exist, they require significant investments and long-term planning. However, there are immediate short-term solutions that address emission intensity and align with farmers’ objectives, such as improving productivity, food security and livelihoods. Increasing the productivity of livestock and rice production systems can directly impact emission intensity and help avoid horizontal expansion, such as land expansion and deforestation. Unlike other sectors, agriculture has no “plug-and-play” options, and mitigation solutions will always have to be adapted and validated in the local context.

Transparency is also an issue in agricultural methane estimates, as bottom-up estimates are highly uncertain due to a lack of country-specific emission factors and low-quality data. More research is needed to develop emission factors in the global south, as satellite images used in other sectors are not viable for agriculture methane.

Insufficient and poorly targeted investment is another challenge, with around USD 630 billion in annual domestic support for agriculture not sufficiently targeting environmental outcomes. Public funds need to be redirected towards climate objectives, with more international climate finance targeting methane mitigation. Projects need to be developed to mobilize this finance from international climate funds and development banks. Financing institutions are slowly raising their awareness and changing strategies to accommodate this.

The Hub proposes a global programme to accelerate research and development on enteric methane. Existing practices, such as improving productivity, husbandry and animal health, are essential but insufficient to meet the Paris Agreement’s targets. More

cost-effective solutions which directly target the methane-producing processes within the rumen are needed. There has been some promising progress on feed additives, but more tools explicitly targeting grazing animals, and more fundamental science on the rumen, are required. The programme could support long-term trials for feed additives and inhibitors to build confidence for farmers and consumers. The programme's outputs will be immediately available to the public in order to accelerate progress. The accelerator will also provide opportunities for venture capital to come in with more significant funding. The ambition is to raise USD 200 million over five years from philanthropy, the private sector and governments. USD 60 million has already been identified from foundations. Any governments and partners interested in joining this initiative are welcome.

The Hub also plans to invest in short-term solutions, such as capacity building on feed ration formulation and nutrition requirements. Currently, there are no plans to invest in natural methane capture technologies, as they require more research and development than other more readily available methane reduction technologies.

Mitigation actions in livestock system in Asia and the Pacific: Example from Viet Nam

Presented by Tran Dai Nghia, ASEAN-CRN focal point Viet Nam, Director, Department of Natural Resources and Environmental Economics Studies, Institute of Policy and Strategy for Agriculture and Rural Development (IPSARD)

In early 2022, ASEAN-CRN collaborated with a number of partners including FAO, the Regional Community Forestry Training Centre for Asia and the Pacific, the ASEAN Working Groups on Forestry and Social Forestry, the ASEAN Negotiating Group for Agriculture, the ASEAN Secretariat, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), CCAC, and the United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation (UN-REDD) initiative "Climate change mitigation through social forestry actions in ASEAN countries". ASEAN-CRN organized a series of consultations to develop a long-term vision for the agriculture sector in Asia. ASEAN-CRN's vision for 2050 is for a resilient, bio-diverse and pollution-free agrifood system that provides healthy and nutritious food for all by 2050. Many countries have identified emissions reduction actions as part of their commitments under the Paris Agreements, including regarding livestock.

The main GHG mitigation plans in the livestock sector are similar across Asian and Pacific countries. Feeding strategies exist for reducing enteric methane, such as increasing concentrates, improving forage quality and applying methanogen inhibitors (tannin, lipid, 3-Nitrooxypropanol, red seaweeds) and methane absorbers (bio-char and zeolite). Strategies to mitigate GHG emissions from manure management include composting to produce organic fertilizer, and using manure in biogas digesters. Efficient exploitation and building of new biogas digesters are crucial. A strategy to avoid overloading the digesters is to separate liquid waste (urine and water) from solid waste. For example, Viet Nam's environmental law requires farmers with a certain production size to have a waste treatment facility, encouraging the use of biogas systems on farms. Surveys were conducted to identify economically viable solutions for smallholder farmers, and small digesters are best suited to meet household needs.

Viet Nam and many countries in the region have committed to global targets in agriculture, such as achieving net-zero emissions by 2050, the GMP, and the Glasgow Declaration on Forest and Land Use. Almost all countries have submitted their updated NDCs.

Viet Nam, for example, has increased its climate commitments in the agriculture, forestry and other land use (AFOLU) sector by contributing to a net emissions reduction of 129.8 Mt CO₂-eq by 2030, with methane emissions not exceeding 45.9 Mt CO₂-eq (30.9 Mt CO₂-eq in crops and 15.2 Mt CO₂-eq in livestock). The sector will contribute to the country's target of net-zero emissions by 2050, while ensuring sustainable development and growth, reducing environmental pollution, and improving the agricultural sector's efficiency, added value and competitiveness. However, the livestock sector's emissions have increased due to growing animal numbers, while rice production areas have decreased.

Unfortunately, climate change impacts mainly poor and vulnerable small farmers. Therefore, mitigation strategies must come with co-benefits for farmers, rather than being a burden. Viet Nam scores its mitigation solutions based on selection criteria such as advantages, disadvantages, scalability, feasibility and co-benefits to define mitigation pathways in agriculture. The country has calculated the mitigation potential for various measures in the livestock sector, including some feed additives that have high potential but also high investment costs.



Tran Dai Nghia, ASEAN-CRN focal point Viet Nam, Director of the Department of Natural Resources and Environmental Economics Studies, IPSARD, facilitates a group discussion during the workshop.



Workshop participants attend a breakout group session during the workshop.

ASSESSING NATIONAL INITIATIVES AND PROGRAMMES ON LIVESTOCK CLIMATE ACTIONS

In this session, participants presented their country's actions and challenges to address climate change in the livestock sector, and tried to identify synergies and trade-offs with the sector's development objectives. Participants were given the following questions to prepare a short presentation:

- *What are the national priorities for tackling climate change in the livestock sector?*
- *What are the synergies between livestock development objectives and climate actions (enteric methane and manure management systems)?*
- *What are the trade-offs and barriers to addressing climate change in livestock?*

Australia

The Government of Australia has committed to reducing economy-wide emissions by 43 percent below 2005 levels by 2030, and achieving net-zero emissions by 2050. Industries are setting industry-specific priorities and objectives for climate actions, with the red meat industry aiming for carbon neutrality by 2030, and the dairy industry planning to reduce GHG emissions by 30 percent by 2030.

Although Australia's red meat and dairy industries are export-focused, trading partners' expectations for methane emission mitigation have prompted industry groups to invest in mitigation technologies to remain preferred suppliers. Livestock industry groups and producers understand that reducing emissions per unit of a product increases herd productivity and economic returns.

The National Farmers' Federation created the Australian Agricultural Sustainability Framework at the end of 2022 to meet trading partner obligations and help farmers engage with new and emerging environmental markets. This project is part of "Animalplan 2022 to 2027", Australia's national action plan for production animal health. However, investing in emissions reduction research and development may come at the opportunity cost of other development areas. The adoption of new technologies and the cost involved may lead to uncertainty about long-term profitability, while data collection and implementation time present additional challenges.

Bangladesh

In December 2020, Bangladesh presented its Eighth Five Year Plan (2020–2025) to attain the SDGs. The plan includes reducing GHG emissions by an additional 10 percent from business-as-usual levels by 2030, or 24 Mt CO₂-eq in the energy, transport and industry sectors, with support from the international community, using 2011 as the base year. The country has also prepared a road map to formulate a comprehensive NAP. The government has operationalized the Climate Fiscal Framework, providing principles and tools for climate fiscal policymaking, which helps to identify the demand and supply sides of climate fiscal funds. The Climate Change Trust Fund has been established from the government's resources to promote sustainable production of milk, meat and eggs, including processed products, and to develop climate-resilient, low-cost feed and fodder production.

Bangladesh aims to reduce methane emissions from enteric fermentation by replacing low-productive animals with high-producing crossbred cattle, and improving feeding strategies using balanced diets and beneficial microorganisms.

The country also promotes mini biogas plants to reduce N₂O and methane emissions from manure management, and raises awareness through training programmes and extension activities. Bangladesh is focused on feed and feed additives to reduce methane emissions, but has identified barriers such as the lack of technologies and limited awareness for implementing breeding programmes for climate-tolerant species and high-yielding animals, improving animal feed and manure management, and managing slurry manure for biogas production. Small-scale farms are common in the country and may present challenges for implementing some actions, such as improving good animal health and husbandry.

Bhutan

In Bhutan's Renewable Natural Resources Strategy 2040, the Department of Livestock has listed actions to tackle climate change, such as propagating efficient breeds of livestock species through selective breeding, reducing the free-ranging livestock rearing system to a confined rearing system, exploring efficient animal feed and fodder resources, and pursuing climate-resilient native breed conservation and propagation. The country promotes small- and medium-scale biogas production, with 8300 domestic-sized biogas plants installed by 2021, and propagates effective microorganism technology.

The mitigation measures bring some co-benefits. For instance, selective breeding and the promotion of efficient breeds reduce the proportion of unproductive animals. Reducing the free-ranging cattle system can protect natural resources and the environment. Moreover, improving feeding, breeding and animal health enhances productivity per unit of livestock and promotes more resilient livestock farming, while reducing methane emissions. Furthermore, more efficient conversion of methane for cooking reduces energy use and firewood, saves time and decreases drudgery, particularly for women.

Bhutan, like many other developing countries, faces the challenge of feeding a growing population while carrying out environmental conservation and GHG mitigation measures with limited agricultural land. There is a possibility that small-holder farmers may lose significantly from high initial investment costs. Livestock intensification may exacerbate gender inequalities and increase the burden of women's labour and responsibilities.

Cambodia

In Cambodia's Climate Change Strategic Plan 2014–2023, the government established a framework of objectives, strategies, and actions to address climate change. The plan aims to reduce GHG emissions from livestock and crop production through the promotion of renewable energy consumption, such as biomass and biogas. MAFF of Cambodia is leading the promotion of biodigesters as a solution to manage agricultural waste, providing additional income, access to clean energy, and bioslurry. Cambodia is also encouraging vulnerable farmers to adopt more efficient and proper agriculture technologies to increase adaptation to climate-related challenges. However, Cambodia faces obstacles in the widespread adoption of biodigesters. These include a lack of confidence in biogas technology among users and investors, limited financing mechanisms and research and development, and low technical know-how in design, planning, operation, and maintenance practices.

Fiji

The Government of Fiji is prioritizing climate-smart agriculture in its NAP, integrating mitigation actions in the livestock sector with adaptation and resilience considerations. Planned actions include increasing access to resilient livestock breeds, promoting sustainable resource management and climate-smart agriculture practices, and developing a national livestock GHG inventory. The five-year Strategic Development Plan (2019–2023) and Fiji Biogas Programme include introducing biogas digesters, promoting breeding programmes for climate-resilient livestock, and improving animal nutrition and feeds. Fiji's Low Emissions Development Strategy 2018–2050 aims for net-zero emissions by 2050, with livestock production playing a role in improving access to red meat and diversifying farms. Small-scale farms are common and focused on food and income security, but technical capacity and expertise, funding for research and development, and lack of access to resources, could pose challenges to implementation.

Indonesia

In 2021, Indonesia submitted its Long-Term Strategy for Low Carbon and Climate Resilience 2050. It aims to contribute to global emission reduction and achieve national development objectives while prioritizing social justice and climate-resilient development. The enhanced NDC identified two key actions to reduce emissions from the livestock sector: utilizing livestock waste for biogas, and improving livestock feed supplements. The government aims to use manure for biogas from 166 000 to 249 000 cattle in 2030, with subsidies to aid the high investment cost. Feed supplementation will be given to 6.9 million to 8 million ruminants by 2030. The Ministry of Agriculture has been working to balance livestock population growth, animal welfare and methane emissions reduction. Integrating palm oil and livestock could enhance green fodder and feed quality, while combining grassland with legume crops will improve soil fertility and reduce methane. Despite challenges due to low capital and farmer capacity, Indonesia is committed to reducing livestock emissions while feeding a growing population and preserving national culture.

Lao People's Democratic Republic

Climate change poses significant risks to natural resources in the Lao People's Democratic Republic, which can affect livestock through disease outbreaks, droughts and floods that also impact grazing land and feed availability. The country plans to enhance animal surveillance systems, improve feeding and grazing areas, and activate farm monitoring and technology transfer. Vaccination campaigns regularly protect animals in high-risk areas, mountainous regions, impoverished and vulnerable areas, and remote regions. The National Growth and Poverty Eradication Strategy recognizes the role of livestock in poverty reduction, particularly in upland and sloping land areas. To improve the meat value chain, forage quality can be enhanced by providing good quality green fodder and urea treatment on crop residues. Additionally, the country aims to improve animal health, husbandry and breeding. The lack of facilities and certification bodies for verifying product quality in the Lao People's Democratic Republic could pose challenges to food safety and disease transmission. The country needs to improve farm management by smallholders and technology transfer.

Malaysia

Malaysia has launched the National Agrofood Policy 2021–2030 to prioritize food security and safety while conserving biodiversity and natural resources through sustainable agriculture. The plan aims to increase growth and sustainability in the poultry industry, reduce dependency on imported feed for intensive farming, and increase the production of ruminants. Although the country lacks specific policies on livestock to address climate change, current livestock policies have climate co-benefits. Utilizing native cattle breeds under palm oil plantations can reduce pressure on pastureland, while implementing good animal husbandry and better management practices can enhance productivity and reduce GHG emissions. Additionally, animal waste is processed as organic fertilizer to generate more income and improve the nutrient cycle. Malaysia is also investing in research and development to create new feed formulations using local products that can replace imported feed. However, the livestock system needs more research on feeding strategies that improve animal productivity without increasing enteric methane. Although biogas adaptation in the ruminant industries requires large financial inputs and may not be economically viable for farmers, the Malaysian Agricultural Research and Development Institute has developed an economic biogas plant. However, weak waste management rules and laws in Malaysia make promoting the system to farmers a challenge.



Yushara Wijerathna, representative of Australia, during a breakout group discussion.



Fesiliai Tulia Molimau Iosefa, representative of Samoa, presents country actions and challenges to address climate change in the livestock sector.

Mongolia

Mongolia aims to increase animal husbandry productivity and to export ethically and responsibly produced animal products, while reducing the impacts of climate change. The government plans to strengthen the legal environment to ensure the sustainable use of pastureland, the cultivation of forage and the provision of water for livestock. The country faces natural hazards such as harsh winters, droughts and flash floods, causing significant livestock loss. The government aims to reduce the number of livestock to match the carrying capacity of pastures, encourage biodiverse planting, and protect underground water resources.

The implementation of the country's NDC needs significant financial support, including USD 11.5 billion, of which USD 6.3 billion is for mitigation and USD 5.2 billion for adaptation. Combining traditional practices with new technologies is essential for reducing emissions. Traceability using technology such as microchips, blockchains and satellite tracking is vital for guaranteeing responsible animal husbandry. Capacity building, knowledge sharing, public education and awareness-raising on climate change are necessary for implementing Mongolia's NDC.

Nepal

Nepal is highly vulnerable to the impacts of climate change, but contributes only 0.11 percent of global GHG emissions. Nepal's priorities to reduce GHG emissions through enhancing cattle and buffalo productivity include genetic selection and breeding, upgrading artificial insemination, and crossbreeding. The country promotes the management of manure and encourages the use of urea molasses multivitamin blocks for better feed utilization. Nepal aims to achieve self-sufficiency in livestock products, increase access to climate-smart technologies and preserve indigenous livestock breeds. However, enteric methane has not been adequately addressed. Nepal needs international support and financing, with USD 3.4 billion for unconditional NDC targets and USD 25 billion for conditional NDC targets.



Batmunkh Damdindorj, representative of Mongolia, presents national plans to ensure sustainable use of pasturelands and natural resources, and to mitigate the effects of climate change on livestock in the country.



Aamer Irshad, representative of FAO Pakistan, and Warocha Jamparat, representative of Thailand, share ideas during a breakout group discussion.

Philippines

Philippines is committed to reducing emissions from enteric fermentation and manure management through breeding interventions and biodigester installations. To achieve these activities, the country needs more technology development and promotion. Additional measures to reduce the carbon footprint of agricultural products include using fast-growing, climate-resilient livestock, agricultural equipment powered by renewable energy, and post-harvest and processing facilities. Philippines also plans to focus on feed and manure management, the adoption of climate information systems, climate-smart agriculture practices, and carbon sequestration measures. The success of these activities will contribute to a sustainable food production system, increase livestock productivity, maintain genetic diversity, and enhance biodiversity. Philippines anticipates potential joint or parallel industrial development, such as increasing demand for feed supplements using other commodities like seaweed. However, increasing livestock production may risk competition for land and diminish genetic diversity. Additional farm interventions may also increase costs for farmers and decrease their profit margins.

The Republic of Korea

The Republic of Korea aims to establish a net-zero strategy for agriculture and food, reducing GHG emissions in the agriculture and livestock sector. The country focuses on promoting low-carbon agricultural technologies and eco-friendly energy, reducing food waste, and improving dietary habits. To achieve sustainable growth in the livestock sector, the Republic of Korea seeks to introduce new technologies for low-methane feed, soil carbon storage and low-input farming. Continuous research, education and extension services are necessary. The Republic of Korea plans to convert animal manure into energy to sustain livestock productivity and reduce its environmental impact. However, there are demographic challenges, including a decreasing agricultural population and the increasing age of farmers, and barriers to technology development and adoption. The country needs to develop technology for improving feed quality, digestibility and animal health, as well as for manure management systems, including biogas plants. Additionally, the improvement of statistical activity data and the development of country-specific emission factors are

necessary to advance the Republic of Korea's national GHG inventory. Grassland management, including biomass increase and expansion of high-quality grassland, is also an important measure with the potential for enhanced carbon sequestration.

Samoa

Samoa aims to reduce GHG emissions in the AFOLU sector by 26 percent in 2030 compared to 2007 levels. The country seeks to enhance resilient and sustainable food and agriculture and fisheries systems, and to increase food and nutritional security. To achieve this, Samoa is implementing several actions such as improving breeds, pasture and rotational grazing, and promoting biogas from manure. The country is also promoting farm diversification and crop-livestock integration at the household level, and managing livestock waste to improve soil quality. Samoa aims to increase total forest cover through reforestation and forest restoration programmes. However, Samoa faces challenges such as incoherent policies, limited financing and budget allocation for the livestock sector, and cultural perceptions of livestock as a “dropout field”. The National Climate Change Policy 2020–2030 outlines adaptation approaches to increase resilience in agriculture and strategies to update and digitize the national GHG inventory. The Ministry of Natural Resources and Environment supports Samoa's efforts to achieve its goals.

Sri Lanka

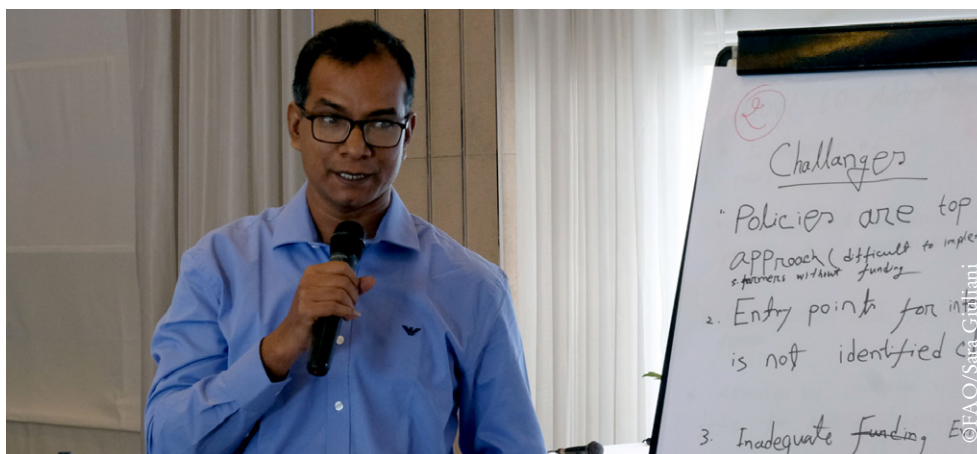
Sri Lanka has identified priorities to address climate change in its livestock sector, including developing climate-resistant breeds, improving animal feed sources and adopting new technologies. The country will also focus on implementing and monitoring foreign-funded climate projects and programmes. These measures are expected to increase stakeholder awareness, promote insurance adoption against loss and damage, and potentially generate additional income through the production of organic fertilizer and renewable energy. However, obstacles to implementation include limited funding, awareness and expertise. Sri Lanka should also intensify large extensive cattle and buffalo herds, and change the feeding method to a high level of feed concentrates, to enhance productivity.

Thailand

Thailand is incorporating climate actions into key policies and plans, such as the draft Action Plan for Climate Change in Agriculture, the Climate Change Adaptation Plan on Public Health, and the revised version of the Mid-century, Long-term Low Greenhouse Gas Emission Development Strategy. Reducing GHG emissions in the livestock sector is a priority, achieved through improving animal feed strategies and breeding programmes. Thailand is implementing anaerobic biogas digesters on farms for better manure management. The country needs technologies, innovations and capacity building to support climate-smart agriculture practices, including precision farming, low-methane rice production and site-specific nutrient management. To promote low-emissions production, Thailand must raise consumer awareness of climate-change issues by promoting livestock products that reduce GHG emissions. However, policy changes and lack of funds could present obstacles to achieving these goals.

Viet Nam

The Government of Viet Nam has issued several important documents including Decree No. 06/2022/ND-CP on GHG reduction, the National Climate Change Strategy to 2050 and the Livestock Development Strategy 2020, among others. The main GHG mitigation options in the livestock sector are to improve animal diets and to reuse animal waste as organic fertilizer and in biogas digesters. Viet Nam has made efforts to improve ecological zoning for CSL and increase the level of high-tech equipment on livestock farms. The country has set targets for reducing GHG emissions in the AFOLU sector by 129.8 Mt CO₂-eq by 2030, with livestock accounting for a portion of this reduction. However, the low investment in implementing measures, low waste collection rates, unstable domestic output markets and underdeveloped carbon exchange markets could hinder progress in addressing climate change in the livestock sector. Additionally, Viet Nam is impacted by extreme weather and environmental pollution, negatively affecting production and livelihoods.



Mohammad Shahadat Hossain, representative of Bangladesh presents the key results of a breakout group session during the workshop.



Mohd Hafizal Bin Ahmad, representative of Malaysia, presents the National Agrofood Policy 2021–2030, a plan that aims to increase growth and sustainability in the poultry industry, reduce dependency on imported feed for intensive farming, and increase the production of ruminants.



Participants discuss the results of breakout group sessions during the workshop.

INTEGRATING LIVESTOCK IN NATIONAL CLIMATE ACTIONS

Challenges and barriers to integrating livestock measures into climate actions

Presented by Andreas Wilkes, Inventory Programme Coordinator, NZAGRC

Almost all countries in the region have included livestock in their NDCs as mitigation and adaptation measures. However, it is not always guaranteed that measures will be implemented as a result of international commitments. The presenter described two thought-provoking perspectives on climate action pathways – the “top-down” pathway and the “bottom-up” pathway. The “top-down” pathway is based on the consideration that national climate policies and international commitments trigger climate action. The risks of this pathway are that livestock sector priorities and needs may not be sufficiently considered in developing strategies and action plans. NDCs are often drafted by external experts, and consultations with the livestock sector may be limited. Determining livestock mitigation options requires an evidence base and knowledge of barriers to farmers’ adoption. Livestock sector priorities often need to be better aligned with national climate actions, as climate change policies have changed more frequently than livestock policies in recent years.

The “bottom-up” way is when climate action originates from the livestock sector itself. In this way, livestock sector priorities and the needs of farmers and businesses are considered, and climate co-benefits are identified to determine the sector’s contribution to climate action with sector-specific measures and commitments. The challenges here are that most livestock sector objectives are related to increasing employment, income, and export earnings, rather than climate-change mitigation or adaptation. Some livestock sector policies consider resilience, but rarely reduce GHG emissions. There are trade-offs and synergies between livestock sector priorities and climate actions, and analyses are needed to determine co-benefits and trade-offs. Consideration of climate risks is also often lacking in developing livestock policies. Challenges and barriers to climate actions in the livestock sector are related to the level of awareness among actors on climate change, GHG emissions and mitigation issues, climate policy processes, assessment capacities, policy dialogue and investment design, climate risks, the evidence base for adaptation and mitigation options, socioeconomic barriers to adoption of good practices, and stakeholder collaboration and public-private cooperation.



Andreas Wilkes, Inventory Programme Coordinator, NZAGRC, presents challenges and barriers to integrating livestock measures into climate actions.



Andreas Wilkes, Inventory Programme Coordinator, NZAGRC, explains that challenges to climate actions in the livestock sector are also related to the level of awareness among actors on climate change and GHG emission and mitigation issues.

Overview of livestock-related interventions and targets in new and updated NDCs in Asia and the Pacific

Presented by Akiko Nagano, Programme Officer (Climate Change in Agriculture), FAO

FAO's 2021 (interim) global update report analysed NDCs submitted to the UN-FCCC by 31 May 2022. Of the 166 parties, 136 submitted new or updated NDCs, with 88 percent of Asian and 62 percent of Pacific countries submitting new or updated NDCs by August 31, 2022. Livestock mitigation actions were included in 51 of the new or updated NDCs globally, with ten in Asia and two in the Pacific. The report identified 1 107 different mitigation actions related to the AFOLU sector globally, with 108 related to livestock. However, only 32 percent of livestock mitigation actions had measurable indicators, and only 16 percent estimated the cost of implementation. Additionally, only 13 percent of livestock actions were unconditional, while the rest were conditional on receiving international financing or did not specify their conditionality.

LIVESTOCK METHANE MITIGATION: RESEARCH, POLICIES AND ACTIONS **Innovative and technological solutions to reduce methane emissions**

Presented by Aimable Uwizeye, Livestock Policy Officer, FAO

Livestock contribute to around 32 percent of global methane emissions, with ruminants being the largest contributors through enteric fermentation. Technical solutions to reduce methane emissions target the Archaea population, block methane formation or change the rumen composition. Solutions include dietary and rumen manipulation. Genetic options involve selecting low-methane-producing animals. 3-Nitrooxypropylol has proven to reduce methane emissions, but its toxicity risk is high. Seaweed is the most effective option, but food safety concerns prevail. Sustainable enteric methane mitigation strategies that are locally applicable and suitable for extensive and intensive production systems need to be researched to overcome technology adoption barriers. Adequate technical support, delivery mechanisms, and consumer involvement and acceptance, are essential for implementing safe and effective anti-methanogenic strategies. The FAO Livestock Environmental Assessment and Performance Partnership launched a public review of a report on methane emissions in livestock and rice systems, which includes interventions to reduce methane emissions. Solutions are needed for various production systems, including confined, partial, extensive and full grazing systems.



Aimable Uwizeye, Livestock Policy Officer, FAO, presents innovative solutions and technologies countries can use to reduce methane emissions from livestock systems.

Overview of livestock and methane policies and lessons learned

Presented by Frank Mitloehner, Clarity and Leadership for Environmental Awareness and Research (CLEAR) Center, University of California, Davis (pre-recorded video presentation)

Different countries are taking different policy approaches to reduce methane emissions. Primary approaches are:

- government investment to facilitate methane emission;
- carbon trading schemes to incentivize methane emission;
- taxation of methane emissions to encourage technology adoption; and
- mandated methane reduction leading to heard reductions.

In principle, there are two different approaches: governments can work with farmers to incentivize them financially, or they can enforce taxes and mandate the reduction of emissions or departure from farming.

In the United States of America, the government is investing billions to achieve methane reduction by supporting climate-smart commodities. An example is the California Dairy Research Foundation, which awarded USD 85 million to provide financial incentives for dairy producers to adopt climate-smart manure management practices to reduce methane emissions. California's law requires a 40 percent reduction in methane from dairy manure. The state has stimulated private investment, offering funding for anaerobic digesters and an income source through a credit scheme. California dairies have reduced about 30 percent of the sector's manure and enteric methane reduction goal. New Zealand will be the first country in the world to put a price on livestock emissions (by 2025). The proposal comes with financial incentives for farmers to reduce emissions. Methane taxes will be reinvested into research and development in the livestock sector. This taxation approach has caused political discussion and disagreements within the sector. In the Netherlands, discussions are most volatile, leading to farmer protests. The government has proposed closing livestock operations by paying back farms to reduce nitrogen pollution, GHG emissions and herd size by 30 percent. Ireland is also looking into herd size reduction. However, this approach is criticized because of the risk of leakage: reducing herd size in one country may lead to an increase in herd size in a different place as the demand stays the same, meaning it will not reduce total GHG emissions.

The challenge for mitigating enteric methane emission from zebu cattle in Southeast Asia

Presented by Koki Maeda, Japan International Research Center for Agricultural Sciences (JIRCAS)

The livestock population in Japan in 2021 included nearly 1.4 million dairy cattle, 2.6 million beef cattle, 9 million pigs and almost 280 million chickens. Enteric fermentation emissions decreased by 21 percent from 1990 to 2016, mainly due to a decrease in cattle headcount. The latest GHG inventory uses country-specific data and the tier 2 approach to determine methane and nitrogen oxide emission factors, filling data gaps with default values and data from other countries. JIRCAS has collected statistical data on manure management systems.

Japan has implemented a new law for sustainable agriculture, providing funds for farmers adopting environmentally friendly practices and reducing taxes. The country aims to reduce CO₂ emissions from 16.6 Mt in 2013 to 14.8 Mt in 2030, and achieve net-zero emissions by 2050. A national research programme for lowering enteric methane through breeding has begun, and Japan is committed to reducing chemical fertilizer use by 30 percent by 2050 by utilizing the biological nitrification inhibition function in agriculture.

JIRCAS is researching methods to reduce enteric emissions in Southeast Asia, such as utilizing local feed resources, silage, and total mixed ratio preparation. The total mixed ratio feeding strategy reduced enteric methane emissions by 64 percent while feeding local cattle with cashew nut shell liquid (CNSL) mitigated 20 percent of methane emissions in vivo. Ongoing research is investigating the effect of CNSL on beef cattle productivity and meat quality for widespread use in the region, with lower doses being tested for more efficient and practical CNSL use.

Production of biomethane for a circular bioeconomy in livestock to achieve Paris Agreement goals

Presented by Pruk Aggarangsi, Energy Research and Development Institute – Nakhonping, Chiang Mai University

At COP26, Thailand pledged to achieve carbon neutrality by 2050 and net-zero emissions by 2065. The country also committed to enhancing its NDC to reduce GHG emissions by 30 to 40 percent in 2030, up from the previous target of 20 to 25 percent, to reach its carbon neutrality and net-zero goals. In November 2022, Thailand published the revised Mid-century, Long-term Low Greenhouse Gas Emission Development Strategy, outlining policies, priorities, and measures for a low-emission and climate-resilient development. The Alternative Energy Development Plan 2018–2037 aims to increase the proportion of renewable and alternative energy in electricity, heat and biofuels to 30 percent by 2037 and 50 percent by 2050, up from the current share of 16.5 percent. Biogas production from waste is common on farms and has been regulated to control pollution and community impact. Thailand has been working with GIZ to develop biogas technologies for large pig farms, and has allocated subsidies to promote biogas in the sector for 20 years. In 2022, 850 000 m³ of energy from biogas was utilized daily, avoiding 8 500 t CO₂-eq of emissions, and a multi-waste power plant flagship project uses various waste sources to generate biomethane for sale to gas stations and the national energy network.

Towards climate neutral 2050

Presented by Amnat Chidthaisong, Joint Graduate School of Energy and Environment, King Mongkut's University of Technology Thonburi (KMUTT)

KMUTT and the Thai livestock industry are collaborating to support Thailand's goal of achieving climate neutrality by 2050. Livestock production in Thailand accounted for 20 percent of the country's agricultural emissions and 15 percent of total emissions in 2016 (52 Mt CO₂-eq out of 354 Mt CO₂-eq). To reduce GHG emissions, the collaboration framework is estimating baseline emissions and developing emission factors for Thai livestock production systems. The first phase (2022–2026) targets maize, dairy cattle, non-dairy cattle, and fishmeal, with subsequent phases focusing on mitigation targets and options. Field measurements conducted in 2022 show that the direct emission factor of N₂O from maize for animal feed is 15 percent lower than IPCC estimates. Thailand is also researching plant microbiome manipulation for livestock feed, and implementing biogas plants to help achieve carbon neutrality.

IMPLEMENTATION AND SUPPORT MECHANISMS FOR THE GLOBAL METHANE PLEDGE

CCAC strategy to support countries and the Global Methane Pledge

Presented by Catalina Etcheverry, Programme Manager, CCAC

The CCAC is a partnership consisting of 76 national governments and many other partners. It supports climate and clean air solutions by improving capacity in national institutions, promoting science-based policies and catalysing action in key sectors. The new phase of CCAC focuses on reducing methane in line with recommendations of the Global Methane Assessment and UNEP's Emission gap report,

and in support of the GMP. The CCAC addresses SLCPs to quickly reduce near-term warming while maximizing development health and food security. SLCPs are more potent than CO₂ and account for up to 45 percent of global warming, contributing to air pollution and crop losses. Quick action on SLCPs can avoid 0.6 °C warming by 2050 and prevent dangerous climate tipping points. CCAC national planning support aims to tailor solutions to country priorities and engage across sectors and ministries. Direct support includes training and capacity building, expert assistance, policy support, technology demonstrations, political outreach and awareness-raising. The CCAC Engagement Strategy for the Agriculture Sector aims to maximize SLCP reduction by 2030 and advance net-zero climate mitigation strategies. The Agricultural Hub provides peer-to-peer exchange, technical discussions, and the latest science and analysis to support countries. CCAC also offers technical assistance on methane through tools and guidance and external experts.

Pathways to dairy net zero

Presented by Donald Moore, Chief Executive Officer, Global Dairy Platform

The dairy sector supports the livelihoods of about 1 billion people globally through 133 million dairy farms. The sector is also crucial for its contribution to the global food system, providing food and nutrition to an estimated 6 billion people, and being the largest agriculture commodity by value and the third largest by volume. Dairy production is responsible for about 10 percent of protein production and 40 percent of calcium humans need in their diet globally.

GHG emissions remain the highest priority sustainability challenge for the dairy sector. To address this, the Dairy Sustainability Framework was launched in 2013 and has now been joined by over 150 organizations. The Pathways to Dairy Net Zero initiative was also launched to systematically introduce or enhance climate action in global dairy systems while balancing other environmental, social and economic considerations. Actions in 2022 include finalizing the new typology of dairy production systems, understanding relevant mitigation interventions, estimating baseline emissions, and modelling scenarios to define mitigation pathways. While there is a 40 percent GHG reduction potential in no-regret solutions, mainly in emerging markets, a total technological reduction potential of around 75 percent exists if technologies can be scaled up widely.

To support the GMP, the initiative has identified ten countries from emerging markets that are responsible for 30 percent of global dairy emissions. These countries are being approached by the United States State Department and the Global Dairy Platform to sign on as “early adopters” and apply for Green Climate Fund (GCF) support. Recently, the GCF approved USD 3.5 million of project preparation funding to support the development of a regional public-private livestock sector programme for Kenya, Rwanda, Uganda and the United Republic of Tanzania.

Summary of group discussions

KEY CHALLENGES, BARRIERS AND NEEDS TO IMPLEMENT CLIMATE ACTIONS IN THE LIVESTOCK SECTOR

During the first breakout group session, participants discussed the challenges and barriers to taking climate action in the livestock sector and identified the necessary steps to overcome them. Challenges such as population growth, urbanization, increased demand for animal products and reduced natural resources availability (such as water and pasture) make addressing livestock climate change difficult. Participants recognized that integrating livestock methane mitigation into national climate actions poses political, institutional, technical and financial challenges. Balancing the need for sectoral development, enhancing food security and reducing poverty with the urgency to fight climate change is particularly challenging.

Many countries in the region have included livestock in their NDCs and have signed the GMP. While NDCs set strong commitments, they are not often aligned with national policies and livestock development strategies. There is a need to formulate policies, strategies and action plans that take into account climate goals. Formulating NDCs is mainly under the responsibility of countries' departments or ministries of environment, but the implementation of livestock development programmes is the responsibility of a department or ministry of agriculture or livestock. This calls for the reinforcement of institutional arrangements and better coordination of climate action at national level.

Participants agreed that limited stakeholder awareness of the relationship between climate change and livestock is a barrier to a political willingness and institutional readiness to address livestock climate actions. To raise awareness and increase policymakers', researchers' and farmers' knowledge of addressing climate change in the livestock sector, it is necessary to enhance communication, demonstrate the contributions of the livestock sector to addressing climate change and empower farmers with tangible benefits. Farmers must be aware of available technical and innovative mitigation options or best practices, such as enhancing animal health, to reduce GHG emissions.

Access to finance or incentives to adopt new technologies or implement changes to practice is necessary. Champions who can demonstrate the success of new technologies is critical to enhancing adoption rates among smallholder communities. More research into locally adaptable solutions is also necessary, as are the tools for monitoring and evaluation to demonstrate the mitigation and adaptation potential. Building national capacity to enhance national GHG inventories by adopting a tier 2 approach and improving measurement, reporting and verification (MRV) systems to enhance transparency, are also necessary despite the limited data availability.

The limited national budget allocation to the livestock sector and difficulties in accessing international climate finance are other challenges. The sector also suffers from low private and public investment as it is considered risky for investments, mainly due to its vulnerability to climate change. De-risking the sector and finding new financing solutions for farmers are necessary.

Some countries face challenges related to the supply and demand of livestock products. Those able to supply large quantities of animal products, such as Mongolia, face barriers to accessing international markets through trade restrictions, resulting in high methane emissions and land degradations from the high stocking of live animals. In contrast, others countries receive high demand from international markets but may not be able to supply or even cover national demand.

CO-BENEFITS, SYNERGIES AND TRADE-OFFS BETWEEN LIVESTOCK DEVELOPMENT AND MITIGATION INTERVENTIONS

During the second breakout group session, participants identified key interventions to reduce methane emissions in livestock systems and discussed their co-benefits, synergies and trade-offs with livestock development objectives. They also identified practices and opportunities to enhance soil carbon sequestration in grasslands.

Most countries aim to increase livestock production and enhance animal health and productivity to improve farmers' incomes. Interventions in animal health, breeding, feed and nutrition can improve livestock productivity and have clear co-benefits

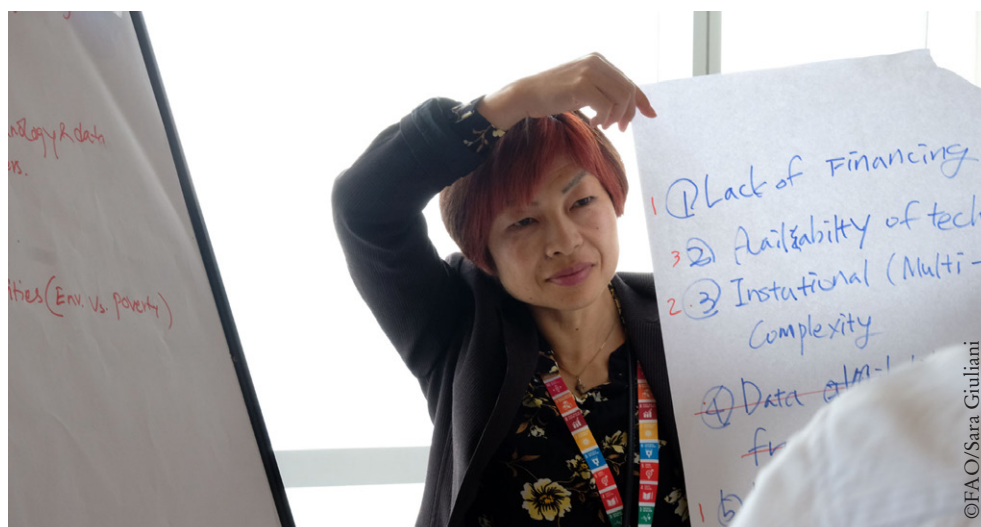


K.M.H.G. Sarath Priyantha, representative of Sri Lanka (top) and Tashi Dhendup, representative of Bhutan (bottom) moderate two group sessions during the workshop.

for GHG emissions mitigation. However, the projected increase in livestock production in most countries will lead to an increase in absolute methane emissions. Efforts to mitigate GHG emissions from the sector focus on reducing emission intensities per unit of product by enhancing efficiency or avoiding emissions.

Low-cost interventions, such as enforcing existing policies and best practices, are usually feasible for farmers. However, feed improvements and comprehensive breeding programmes require investment, and there are potential trade-offs such as decreasing biodiversity, the disappearance of local breeds and the development of new diseases. Participants also identified synergies between agriculture and the energy sector, such as managing manure for biogas production, which reduces emissions and provides clean energy and composting manure, improves the soil, and reduces the use of synthetic fertilizer. Reducing animal numbers would benefit the climate and herd health, but negatively impact household income.

During the discussion, participants also discussed enhancing soil carbon sequestration in grasslands. They suggested several measures to improve grasslands, including integrating legume species to enhance nitrogen fixation, optimizing animal



Workshop organizers Akiko Nagano, Programme Officer (Climate Change in Agriculture), FAO (top) and Beau Damen, Natural Resources Officer, FAO RAP (bottom) facilitate a group discussion during the event.

numbers on grasslands, and adapting cutting intervals. Additionally, they recommended that livestock be better integrated into national emission trading schemes and voluntary carbon markets under Article 6 of the Paris Agreement.

ROAD MAP FOR CLIMATE ACTIONS AND POLICIES

In the third breakout group discussion, participants had the opportunity to discuss different scenarios to enhance mitigation interventions while pursuing sustainable livestock development objectives. This group discussion was based on a case study of a fictional country named “Livestockland”. Livestockland has a population of 7 million, with 60 percent of inhabitants living in rural areas and 40 percent in urban areas. Around 40 percent of the population lives under the poverty line. By 2050, the Livestockland population is projected to increase by 50 percent, with urbanization, climate change, technology and poverty reduction as megatrends.

The gross domestic product (GDP) is USD 18 billion, growing at 4.8 percent annually, with livestock contributing 10 percent to the agriculture GDP and 3 percent to the national GDP. Livestock production involves 122 500 households, mainly rearing cattle for milk and meat. Livestockland aims to both increase milk production fourfold by 2030, and to reduce methane emissions by 15 percent. The government has established a national coordination taskforce to implement these goals. The success of Livestockland’s objectives depends on the quality of its governance and economic systems. The detailed on the case study is provided in Annex 2. Four scenarios were discussed in four groups, as follows:

- i. In this scenario, Livestockland has a **strong economy and weak governance**. The scenario is characterized by a thriving economy and high inequality, with only a few livestock farmers being economically secure, and the majority of the population struggling with unstable incomes due to bad governance and an inefficient government that cannot provide adequate public goods and services. To improve livestock development, potential interventions include importing new improved cattle; vaccination; developing existing headcount for production efficiency; adopting new technologies for animal health, breeding, feeding, and grassland, herd and manure management; establishing monitoring bodies; increasing formal education; implementing transparent financial mechanisms; and bringing in foreign experts in dairy production for advisory support. The road map to reduce methane emissions while enhancing livestock development involves more coordination between the government and private sector, training of trainers, dissemination of information, extension services, and awareness campaigns on methane emission reduction and productivity improvement. To achieve these objectives, the government must review existing laws and policies, establish taxation rules and procedures, provide subsidies to incentivize farmers and supply chain actors, develop insurance policies, implement disease control policies, and promote proper and sustainable utilization of natural resources.
- ii. In this scenario, Livestockland is facing challenges with **weak governance and a weak economy**. The livestock sector is also dealing with animal diseases, low productivity and misuse of natural resources. To ensure sustainable development and reduce methane emissions, Livestockland is seeking international support for disease control programmes, capacity building and genetic improvement. Policy interventions include improving land use,

tracking GHG emissions and adopting good animal husbandry. Livestockland must improve accountability and build partnerships with the private sector and non-state actors. However, there are trade-offs related to budget competition, sustainable intensification and loss of biodiversity. Additionally, the country needs to open up for foreign investments and establish farmers' cooperatives.

- iii. In this scenario, Livestockland has **strong governance**, accountability, stable institutions and a diversified, **strong economy**. To increase milk production and reduce methane emissions by 2030, Livestockland will focus on genetic improvement by adopting embryo transfer and importing highly productive dairy cows, using sex-sorted semen for artificial insemination, converting more land for livestock production, implementing manure management systems, creating incentives for farmers to adopt technology and innovation, and improving animal health and husbandry practices. These elements are included in the national road map for livestock development and climate actions. The country will also adopt strong policies to monitor and evaluate the impacts of these programmes, including carbon footprint, circular bioeconomy, biogas programmes, government bonds to support livestock investments, and enhanced traceability.
- iv. In this scenario, Livestockland has **strong governance but a weak economy**, resulting in low public sector investment. An enabling environment for private sector investment in dairy farming is being developed, however, along with disease control measures for foot-and-mouth disease. The country has established a taskforce to create a coherent policy supporting both livestock development and methane emissions mitigation. The taskforce identified interventions such as reducing non-productive cows, increasing productivity per cow, breed improvement/replacement, feed and nutrition improvement, and disease prevention/control. For methane reduction, interventions include reducing non-productive cattle, improving animal feeding, and installing small to large-scale biogas and better manure management. The road map includes boosting milk production by 50 percent and reducing methane by 5 percent by 2024, doubling milk production and reducing methane by 10 percent by 2026, upscaling biogas production by 2028, and achieving a 15 percent methane emission reduction and substantial milk production increase by 2030. Policies are needed, including measurement and verification of GHG emissions, improvement of the national GHG inventory, and integration of specific livestock interventions in national climate change policies.

Workshop evaluation

Overall, the workshop provided an excellent opportunity for experts from Asia and the Pacific to exchange experiences and views on methane reduction options in the livestock sector. Participants found the workshop agenda and objectives satisfactory, with over 80 percent stating that it met their expectations, and that the knowledge exchanged was useful and applicable to their work. The workshop duration and level of engagement were also excellent.

Participants found the sessions on technology and innovation for reducing methane emissions in intensive and extensive livestock systems, breakout group discussions, and scenario analysis to be the most interesting parts of the workshop. They also found the country presentations of Japan, Thailand and Viet Nam to be insightful. However, the generic presentations on CCAC and livestock and climate change were less engaging.

Participants expressed the need for field visits demonstrating concrete success stories, the provision of more breaks and better IT equipment to avoid hybrid meeting interruptions. They also suggested including additional topics for future workshops, such as carbon markets, climate policy formulation, cultured meat and changing diets.

Outcomes and recommendations and conclusions

The workshop highlighted the urgent need to treat climate change as an emergency and take rapid action. While the livestock sector does contribute to GHG emissions, it is part of the solution to address climate change. Immediate action is required to reduce absolute GHG emissions, with a particular focus on reducing methane, which is a SCLP. Workshop participants explored different pathways to implement and scale up methane reduction solutions, with a focus on long-term investment in research and development. While technical solutions such as feed additives or inhibitors have been identified to mitigate enteric methane, their adoption on the ground requires significant investment and resources. Ready-to-implement low-cost opportunities to reduce emission intensities, such as improving farm and livestock management and feeding practices, need to be scaled up for all farmers.

Policy options for addressing methane emissions were also discussed, with a system of taxation and reinvestment in research and development seen as applicable in countries with a strong and developed private sector. In countries where producers cannot invest, policies need to provide incentives for mitigation or adaptation technologies and changes in practice. Carbon markets for agriculture still need to be better adapted for farmers, and more research and development into economically feasible technical solutions for smallholder farmers is needed.

Discussions on manure management, biogas production, and feed and feeding management including feed additives to reduce methane emissions, were of particular interest. Participants also recognized the value of sharing expertise and understanding its application in local contexts. Participants emphasized the importance of collaborating with all stakeholders, including the private sector, to address climate change. The workshop successfully reached its objectives, with participants appreciating the breakout discussion sessions and the opportunity to learn from each other. They committed to sharing the knowledge and experience gained from the workshop with their peers and colleagues, and recognized the opportunities for international cooperation and access to funding, in particular through CCAC, GCF, the Global Environment Facility and other international financial institutions.

The key recommendations identified in the workshop were as follows:

- Immediately upscale existing best practices and policies on animal health and production, genetics and breeding management, manure management, and feeding to reduce methane emission intensities.
- Increase public finance and private investment in the long-term low-emission and climate-resilient livestock sector.
- Provide more support to countries to go beyond best practices, commit to enhanced international climate actions, and adopt new and innovative technologies.
- Enhance cross-sectoral collaboration to align national climate actions with livestock development objectives and mainstream climate change into

agriculture and livestock policies. Inclusive policy dialogues with all stakeholders can enhance involvement and responsibilities, and reflect the local context for farmers.

- Raise awareness among stakeholders, particularly farmers, on the relationship between livestock and climate change, the role of best farming practices, and the availability of climate-smart solutions.
- Urgently develop road maps and action plans to ensure that policies and international commitments lead to the implementation of livestock climate actions on the ground.
- Provide capacity building and technical assistance to enhance GHG inventories, develop emission baselines for livestock, handle and manage livestock data, develop locally appropriate emission factors, and identify mitigation options through strong MRV and Enhanced Transparency Framework.
- To access finance, countries need to demonstrate emission reduction opportunities through interventions. To do so, they must enhance their capacities to measure GHG emissions from the livestock sector and establish targets for emissions reductions.
- Explore the opportunity to establish voluntary carbon markets and sustainable national emission trading systems to leverage climate finance in the livestock sector.
- De-risk the livestock sector to increase private investment and make financing solutions available for farmers, including smallholders, and enhance the national budget allocation for livestock climate actions.



Tenzin Kborlo, representative of Bhutan, presents the outcomes of a breakout group session during the workshop. Bangkok.



Workshop participants pose for a group photo on the last day of the workshop.

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ANNEX 1

Agenda

DAY 1 Monday, 24 October 2022		
Time	Topics	Speakers
8.00–8.45	Registration	
8.45–9.00	Opening and introduction	Moderator
9.00–9.25	Official opening: <ul style="list-style-type: none"> • Scott Newman, Senior Animal Health Production Officer, FAO RAP • Imelda Bacudo, Coordinator of ASEAN-CRN and ASEAN Negotiating Group for Agriculture • Martina Otto, Head of the CCAC Secretariat at UNEP • Gen Kunieda, MAFF of Japan • Wacharapon Chotiyaputta, Director of the Division of International Livestock Cooperation, Thailand Ministry of Agriculture and Cooperatives 	
9.25–9.30	Photo opportunity	
SESSION 1: Livestock and climate change (getting started)		
9.30–9.45	Status, trends and outlook of the development of the livestock sector in Asia and the Pacific	Scott Newman, Senior Animal Health Production Officer, FAO RAP
9.45–10.00	Overview of livestock and climate change	Aimable Uwizeye, Livestock Policy Officer, FAO
10.00–10.25	Plenary discussion	All
10.25–10.30	Housekeeping	Moderator
10.30–11.00	Coffee break	
11.00–11.10	Objectives of the workshop	Saskia Reppin, Livestock and Climate Change Specialist, FAO
SESSION 2: Why address global methane emissions?		
11.10–11.30	Global Methane Pledge and the Paris Agreement: Background, objectives and progress to date	Claire Henly, White House Fellow detailed to the United States Special Presidential Envoy for Climate John Kerry
11.30–11.50	Opportunities for livestock methane mitigation in climate actions in the context of GMP	Hayden Montgomery, Programme Director Agriculture, Global Methane Hub
11.50–12.00	Plenary discussion	All
12.00–12.30	Interactive exercise (idea sharing and discussion with flipcharts and sticky notes)	All
12.30–13.30	Lunch	

SESSION 3: Regional perspective on livestock climate actions		
13.30–13.50	Overview of climate actions in livestock systems in Asia and the Pacific: Example from Viet Nam	<i>Tran Dai Nghia, Director, Department of Natural Resources and Environmental Economics Studies</i>
13.50–14.10	Results from the participant survey on livestock climate actions	<i>Saskia Reppin, Livestock and Climate Change Specialist, FAO</i>
14.10–14.30	Plenary discussion	<i>All</i>
15.00–15.30	Coffee break	
SESSION 4: Country perspectives and approaches to reduce methane in livestock systems		
15.30–16.50	Country perspectives: <ul style="list-style-type: none"> • What are countries' priorities for livestock climate actions? • What aspects of countries' livestock development objectives have synergies with methane mitigation (enteric methane and manure management systems)? • What aspects have potential trade-offs to address? 	<i>Country participants</i>
16.50–17.30	Plenary discussion and participant reflections	<i>All</i>
17.30–17.40	Summary of day 1	<i>FAO</i>
17.40	End day 1	
19.00	The evening reception	<i>All</i>

DAY 2 Tuesday, 25 October 2022		
Time	Topics	Speakers
8.30–8.45	Welcome	<i>Moderator</i>
8.45–9.00	Recap day 1 and objectives of day 2	<i>FAO</i>
9.00–9.10	Participants' reflections on day 1	<i>All</i>
SESSION 5: Challenges to integrating livestock methane mitigation into national climate actions		
9.10–9.30	Overview of challenges and barriers to integrate livestock-specific measures into climate actions	<i>Andreas Wilkes, Inventory Programme (International) Coordinator, NZAGRC</i>
9.30–9.40	Introduction to the breakout group discussions Presentation of concepts and questions to be discussed, anticipated outcomes of the discussion and facilitation	<i>Facilitators</i>
9.40–10.10	Coffee break	
10.10–11.30	Breakout group discussions Questions will be prepared and each group will have a facilitator and a rapporteur to guide the discussions: <ul style="list-style-type: none"> • What are the key challenges and barriers to implement climate actions in the livestock sector? • What are the needs to address these challenges and barriers? 	<i>All</i>
11.30–12.30	Plenary reporting From each group, one rapporteur will report back to plenary	<i>All</i>
12.30–13.30	Lunch	

SESSION 6: Opportunities to integrate livestock methane mitigation interventions in national climate actions		
13.30–13.50	Overview of livestock-related interventions and targets in new and updated nationally determined contributions in Asia and the Pacific	Akiko Nagano, Programme Officer, Climate Change in Agriculture, FAO
13.50–14.10	Plenary discussion	All
14.10–15.30	Breakout group discussions Questions will be prepared and each group will have a facilitator to guide the discussions: <ul style="list-style-type: none"> • What are the main co-benefits, synergies and trade-offs between livestock development objectives (e.g. animal health programmes, increasing productivity) and mitigation options? • What are key interventions for reducing methane emissions in livestock systems? Identify the key interventions (e.g. practices, technologies or policies) and discuss their potential to transform the livestock sector towards a low emission development. • What are practices and opportunities to enhance soil carbon sequestration on grasslands (removals)? 	All
15.30–16.00	Coffee break	
16.00–17.00	Plenary reporting From each group, one rapporteur will report back to plenary	All
17.00–17.20	Feedback and summary of day 2	All
17.30	End day 2	All
DAY 3 Wednesday 26 October 2022		
Time	Topics	Speakers
8.30–8.45	Welcome	Moderator
8.45–9.00	Recap day 2 and objectives of day 3	FAO
9.00–9.15	Participants' reflections on day 2	
SESSION 7: Research, innovation, technologies and policies to support methane mitigation		
9.15–9.30	Innovative and technological solutions to reduce methane emissions in intensive and extensive livestock systems	Aimable Uwizeye, Livestock Policy Officer, FAO
9.30–9.45	Overview of livestock and methane policies – lessons learned so far	Frank Mitloebner, Professor and Air Quality Specialist, Department of Animal Science, University of California, Davis, Director of CLEAR Centre
9.45–10.00	Plenary discussion	All
10.00–10.30	Coffee break	
10.30–10.45	Challenge for mitigating enteric methane emission from zebu cattle in Southeast Asia	Koki Maeda, Senior Researcher, Crop, Livestock and Environment Division, JIRCAS

10.45–11.00	Production of biomethane for a circular bio-economy in livestock to achieve Paris Agreement goals	<i>Pruk Aggarangsi, Director, Energy Research and Development Institute Nakornping, Chiang Mai University</i>
11.00–11.15	Towards Climate Neutral 2040: Collaboration framework between KMUTT and Thai livestock industry	<i>Amnat Chidthaisong, Joint Graduate School of Energy and Environment, KMUTT</i>
11.15–11.35	Plenary discussion	<i>All</i>
SESSION 8: Implementation and support mechanisms for Global Methane Pledge		
11.35–11.55	CCAC strategy to support countries to address methane	<i>Catalina Etcheverry, Programme Manager, CCAC</i>
11.55–12.15	Pathways to Dairy Net Zero	<i>Donald Moore, Executive Director, Global Dairy Platform</i>
12.15–12.30	Plenary discussion	<i>All</i>
12.30–13.30	Lunch	
SESSION 9: Call for action		
13.30–13.40	Interactive exercise: Presentation of methane mitigation scenarios and explanation of the tasks (enteric fermentation and manure management systems) Scenarios will be prepared beforehand	<i>Facilitators</i>
13.40–14.40	Breakout group discussion: Questions will be prepared and each group will have a facilitator to guide the discussions. <ul style="list-style-type: none"> • What are the key actions to reduce methane emissions from enteric fermentation and manure management systems? • What are the existing market mechanisms and experiences that can be scaled up to address methane and enhance the sustainability of the livestock sector? • What are the opportunities for regional collaboration to enhance methane mitigation in Asia and the Pacific? 	<i>All</i>
14.40–15.10	Plenary reporting From each group, one rapporteur will report back to plenary	<i>All</i>
15.10–15.30	Coffee break	
15.30–15.50	Summary of the workshop (call for action)	<i>Moderator</i>
15.50–16.10	Feedback, evaluation of the workshop	<i>Moderator</i>
16.10–16.30	Closing remarks <ul style="list-style-type: none"> • FAO • CCAC 	

ANNEX 2

Case study – Livestockland

COUNTRY CONTEXT

Livestockland is a small country with a population of about 7 million, with 60 percent of inhabitants living in rural areas and 40 percent in urban areas. Around 40 percent of the population lives under the poverty line. The annual population growth rate is 2.5 percent. Livestockland has a GDP of USD 18 billion, with an average annual growth rate of 4.8 percent.

Cattle is the main species of livestock in the country, kept for both milk and meat production. A total of 122 500 households are involved in livestock production for their consumption and the market. The current contribution of livestock to agriculture GDP is estimated at 10 percent, with the contribution to national GDP at 3 percent. There are an estimated 3 million head of dairy, of which one-third is reared on natural grassland dairy systems and two-thirds reared in mixed rain-fed dairy systems. There are two types of farms: a small-scale dairy subsystem with an average herd size of ten heads, and a medium-scale dairy subsystem with a herd size of 50 heads. In mixed rain-fed systems, the herd size is medium with an average of 32 heads. Major cattle diseases such as foot and mouth disease are endemic to Livestockland, but the country also has a large availability of natural resources, such as grassland and water resources.

Livestockland produces about 500 000 kg of milk per year, which is not sufficient to satisfy the national demand. The Government of Livestockland has set objectives to increase milk production by fourfold to 2 million kg by 2030, and also to reduce greenhouse gas emissions. The baseline methane emissions are estimated on average at 94 kg CH₄ per animal, equivalent to 7.6 Mt CO₂-eq. The government has set the goal of reducing the average methane emissions by 15 percent by 2030, following its commitment to join the GMP and the inclusion of these livestock-based targets in its recently updated NDC. Livestockland, however, does not have a strong and coherent policy environment, and has recently established a national coordination taskforce to implement both its livestock development and climate action objectives.



MEGATRENDS BY 2050 UNDER BUSINESS-AS-USUAL SCENARIO

Population	Urbanization	Climate change	Technology	Poverty
<ul style="list-style-type: none"> Increasing of human population by 50 percent (10.5 M) 	<ul style="list-style-type: none"> Increase in urban population 	<ul style="list-style-type: none"> Warmer temperature Heavy rains Long drought 	<ul style="list-style-type: none"> Access to technology and big data 	<ul style="list-style-type: none"> Reduction of poverty by 10 percent

There are, however, two bottom-line uncertainties that will largely shape how Livestockland will be in 2050 and whether it will achieve its objectives on climate action and livestock development: the governance system and the economic system.

Governance

Governance indicates how the government, through its institutions and rules, guides political, social and economic activities. At the extremes, the governance system can be either good or bad.

- **Strong governance:** High levels of accountability and responsibility; stable institutions
- **Weak governance:** Corrupted and highly unstable institutions

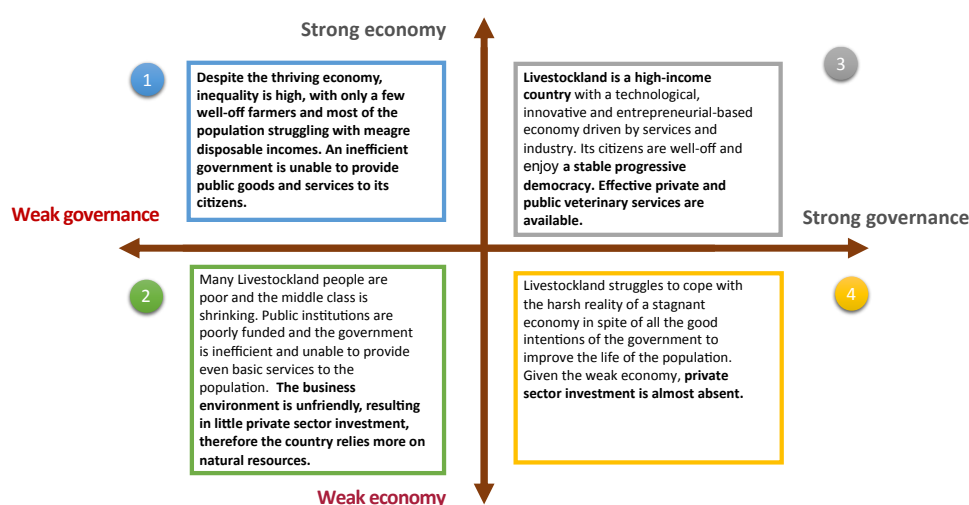
Economic system

The economic system indicates how resources are allocated to produce, distribute and trade goods and services. At the extremes, the economic system can be either good or bad.

- **Strong economy:** Vibrant, thriving and diversified economy
- **Weak economy:** Unidimensional, fragile and weak economy

Based on FAO (2019), four scenarios have been developed.

Figure A2.1. Scenarios for the economic and governance future of Livestockland



Source: Elaborated by the authors.

Your group represents the national coordination taskforce, composed of the Departments of Environment and Livestock, as well as other institutions and stakeholders supporting livestock development. Please select a member of the group to be the chair of the taskforce and the rapporteur. The chair will moderate the discussion, and will ensure that all members of the taskforce contribute.

For today, the assignments of the taskforce are the following:

1. Under the scenario assigned to your group, please discuss and describe **potential interventions** that the government and livestock stakeholders of Livestockland could consider to achieve its livestock and climate objectives by 2030.
2. Can you propose a **road map for the implementation** of these objectives, considering synergies and trade-offs?
3. What **policies** are needed to achieve livestock development and climate action?

REFERENCE

FAO. 2019. *The future of livestock in Kenya: Opportunities and challenges in the face of uncertainty*. Rome. www.fao.org/3/ca5369en/ca5369en.pdf

ANNEX 3

List of workshop participants

Mr Pruk Aggarangs

Director
Energy Research and Development
Institute Nakornping, Chiang Mai
University, Thailand

Mr Mohd Hafizal Bin Ahmad

Veterinary Officer
Department of Veterinary Services,
Malaysia

Mr Madhav Prasad Aryal

Chief Livestock Development Officer
(Joint Secretary)
Department of Livestock Services,
National Livestock Resource
Management and Promotion Office,
Nepal

Ms Benjalak Assawasathitthip

APHCA Administrative and
Programme Assistant
FAO RAP

Ms Imelda Bacudo

Climate, Food and Agriculture and
Land Use Expert
ASEAN-CRN

Ms Marci Baransk

Programme Management Officer
UNEP Thailand

Mr Amnat Chidthaisong

Joint Graduate School of Energy and
Environment, KMUTT, Thailand

Mr Wacharapon Chotiyaputta

Director
Division of International Livestock
Cooperation, Ministry of Agriculture,
Thailand

Mr Batmunkh Damdindorj

Senior Analyst
Livestock Policy Implementation and
Coordination Department, Mongolia

Mr Beau Damen

Natural Resources Officer
FAO RAP

Mr Tashi Dhendup

Department of Livestock, Ministry of
Agriculture and Forests, Bhutan

Ms Catalina Etcheverry

Agriculture and Bricks Initiative
Coordinator
CCAC Secretariat

Ms Sara Giuliani

Communications Specialist
FAO headquarters

Mr Makara Hak

National Technical Adviser – Animal
Health
FAO Cambodia

Ms Claire Henly

Energy Technology and Policy Expert
White House Fellow detailed to the
United States Special Presidential
Envoy for Climate John Kerry, United
States of America

Mr Mikito Higuch

Researcher
JIRCAS

Mr Mohammad Shahadat Hossain

Upazila Livestock Officer
Department of Livestock Services,
Bangladesh

Ms Gicell Iglesias

Agriculturist II/Organic Agriculture
Programme Focal Person
Department of Agriculture, Bureau of
Animal Industry, Philippines

Ms Temwanoku Ioakim

International Expert for Livestock
FAO Subregional Office for the Pacific
Islands

Mr Aamer Irshad

Assistant FAO Representative
Programme
FAO Pakistan

Ms Warocha Jamparat

Senior Animal Husbandry Technical
Officer
Department of Livestock
Development, Thailand

Ms Yeongji Jo

Deputy Director
Ministry of Agriculture, Food and
Rural Affairs, Republic of Korea

Mr K.M.H.G. Sarath Priyantha

Chief Livestock Economist
Livestock Planning and Economics
Division, Department of Animal
Production and Health, Sri Lanka

Mr Surendra Kark

National Technical Coordinator
FAO Nepal

Mr Mohammad Khajeh

Head
Specialized International Organizations
Department, Veterinary Organization,
Islamic Republic of Iran

Mr Phetnakhonexay Khamphoumy

Livestock Management Division,
Department of Livestock and Fisheries,
Lao People's Democratic Republic

Mr Tenzin Khorlo

Chief Environment Officer
National Environment Commission
Secretariat, Bhutan

Mr Satoshi Koike

Japan

Mr Gen Kunieda

Director
Global Environmental Affairs Office,
MAFF, Japan

Mr Mitsunori Kurihara

Researcher
JIRCAS

Mr Abdul Kadir Latulanit

Agriculture Product Market Analyst
Directorate General of Livestock and
Animal Health Services, Ministry of
Agriculture, Indonesia

Mr Ai Leon

Researcher
JIRCAS, Japan

Ms Phoebe Lyndia T. Llantada

Chairperson
DA Greenhouse Gas Team for the
Livestock Sector, Department of
Agriculture, Philippine Carabao
Center, Philippines

Ms Proyuth Ly
Programme Adviser
FAO Cambodia

Mr Koki Maeda
Senior Researcher
JIRCAS, Japan

Mr Setiari Marwanto
Researcher
National Research and Innovation
Agency, Indonesia

Mr Pramol Meak
Chief
Animal Feed Production Manager
Office, Department of Animal
Production, Cambodia

Ms Cheat Meardey
Department of Climate Change,
Ministry of Environment, Cambodia

Mr Frank Mitloehner
Professor and Air Quality Specialist
Department of Animal Science,
University of California, Davis, United
States of America

Ms Fesiliai Tulia Molimau Iosefa
Assistant Chief Executive Officer
Animal Production and Health
Division, Ministry of Agriculture And
Fisheries, Samoa

Mr Hayden Montgomery
Programme Director Agriculture
Global Methane Hub

Mr Donald Moore
Executive Director
Global Dairy Platform

Mr Julius Muchem
Livestock Development Specialist
(Team Lead)
FAO Bangladesh

Ms Akiko Nagano
Programme Officer (Climate Change
in Agriculture)
FAO headquarters

Mr Sonevilay Nampanya
Livestock Development Officer
FAO RAP

Mr Scott Newman
Senior Animal Health and Production
Officer
FAO RAP

Ms Akiko Nishiura
Japan

Ms Keiko Okamoto
MAFF, Japan

Mr Singvilay Olayvanh
National consultant
FAO Lao People's Democratic
Republic

Mr Kazunaga Oshima
Researcher
JIRCAS, Japan

Ms Martina Otto
Head
CCAC Secretariat

Mr Ronil Prasad
Senior Research Officer
Livestock, Ministry of Agriculture, Fiji

Ms Vinna Precyilia
Junior Policy Analyst in MRV
Ministry of Environment and Forestry,
Indonesia

Mr Nathamane Prombairgoen
Department of Livestock
Development, Thailand

Mr MD Hamidur Rahman
Joint Secretary
Ministry of Fisheries and Livestock,
Bangladesh

Ms Saskia Reppin
Livestock and Climate Change
Specialist
FAO headquarters

Ms Yupaporn Simuangngam
Office Assistant
FAO RAP

Ms Jigjidpurev Sukhbaatar
Technical Adviser
FAO Mongolia

Mr Tran Van The
Researcher
Institute for Agricultural Environment,
Viet Nam

Mr Tran Dai Nghia
Director
Department of Natural Resources and
Environmental Economics Studies,
Institute of Policy and Strategy for
Agriculture and Rural Development,
Viet Nam

Ms Seiko Uchida
MAFF, Japan

Mr MD Abu Nasar Uddin
Deputy Secretary
Ministry of Environment, Forest and
Climate Change, Bangladesh

Mr Aimable Uwizeye
Livestock Policy Officer
FAO headquarters

Ms Estella Valiente
Science Research Specialist I
Department of Agriculture, Philippine
Carabao Center, Philippines

Mr Sacksy Vilayhak
Head of Unit, Greenhouse Gas
Mitigation
Department of Climate Change,
Ministry of Natural Resources and
Environment, Lao People's Democratic
Republic

Ms Yushara Wijerathna
Veterinary Officer
Department of Agriculture, Fisheries
and Forestry, Australia

Mr Andreas Wilkes
Inventory Programme (International)
Coordinator
NZAGRC, New Zealand

Mr Raksme Yim
Chief Officer
Ministry of Environment, Cambodia

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