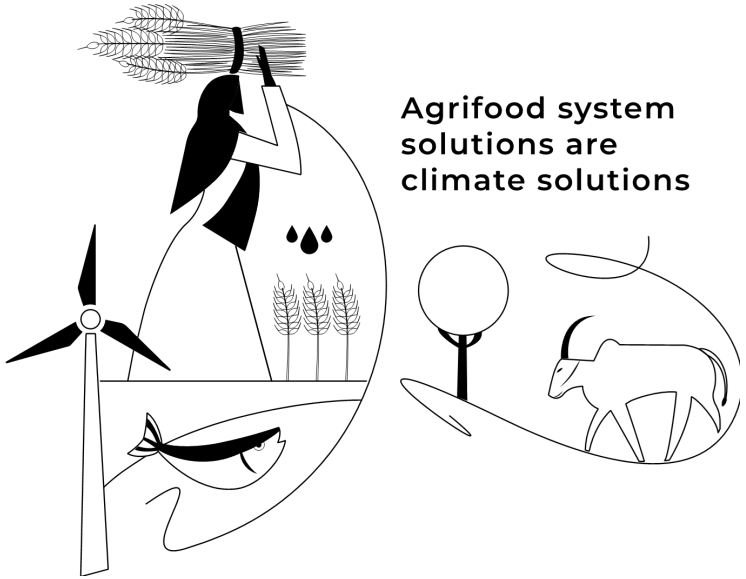


Session 8o. Technologies for GHG emission mitigation on farm: options, opportunities and challenges

Reducing Methane Emissions: A Win-win Solution for Climate and Livestock Agrifood Systems

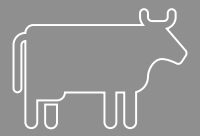
Aimable Uwizeye, *Dominik Wisser*
Livestock Policy Officer, Livestock Innovation, Climate and Post-Harvesting Solutions, NSAL
Animal Production and Health Division, NSA

1

Trends in global livestock systems

2

Greenhouse gas emissions from Livestock systems



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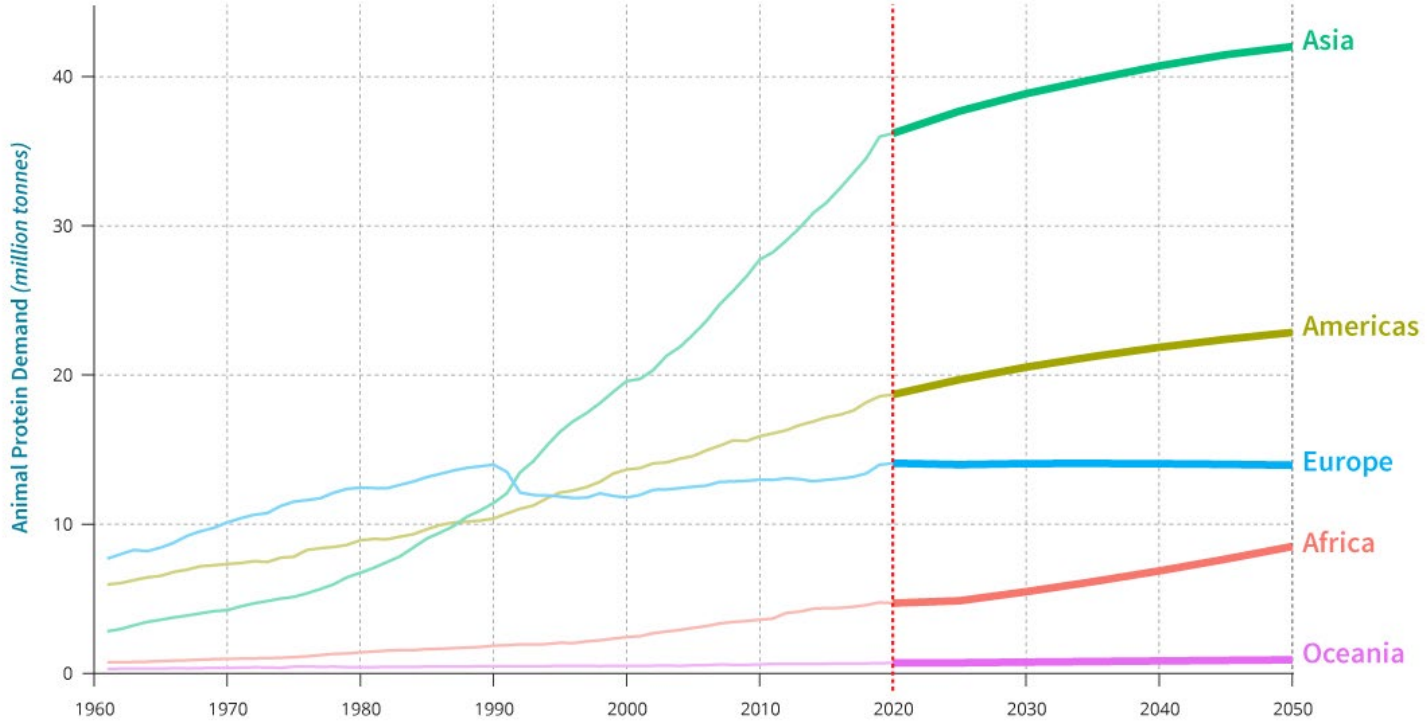
Pathways towards lower emissions

4

FAO's work on livestock climate action

Production of terrestrial animal products is expected to increase by 20% by 2050

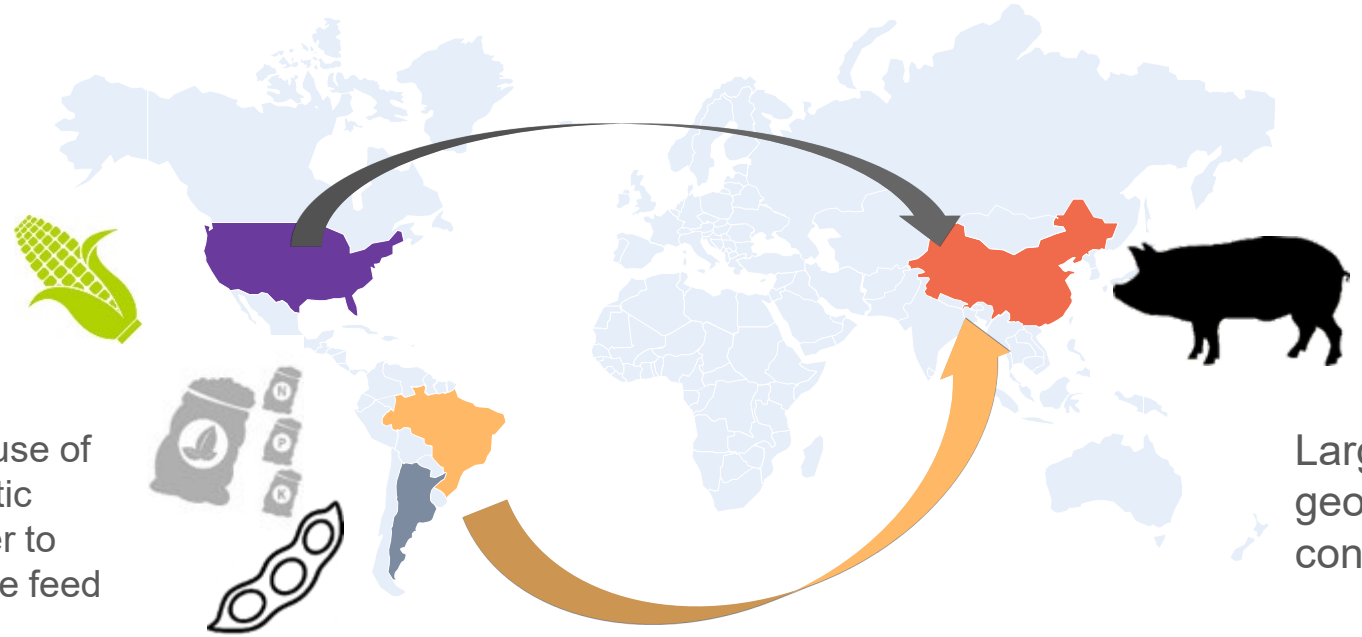


FAO, 2023 – https://doi.org/10.4060/cc9029en

Disconnection between feed and livestock

Small-scale farms

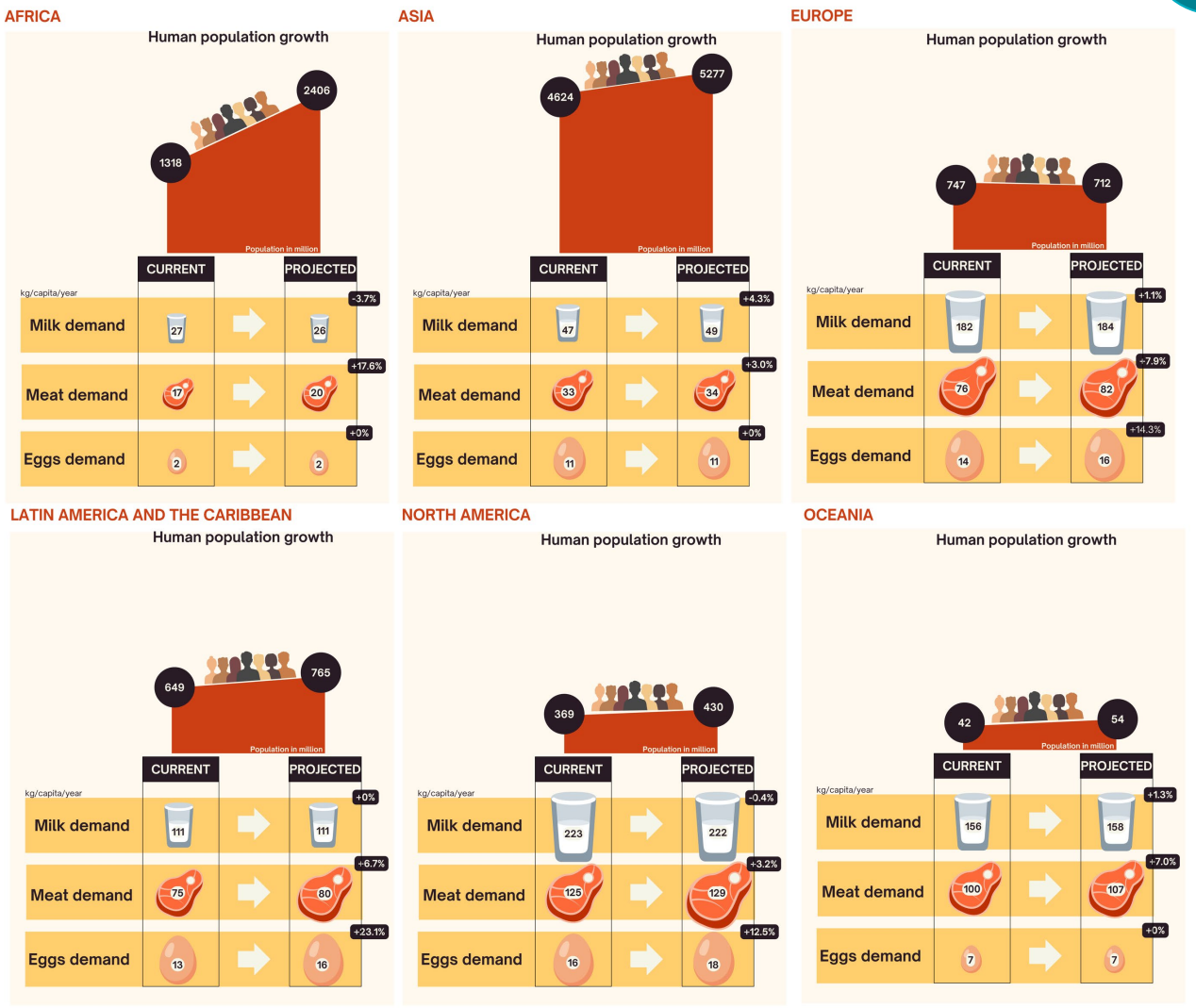
Disconnection between feed production and animal production



Large use of synthetic fertilizer to produce feed

Large-scale and geographically concentrated farms

Trends in global livestock systems



FAO, 2023 – https://doi.org/10.4060/cc9029en

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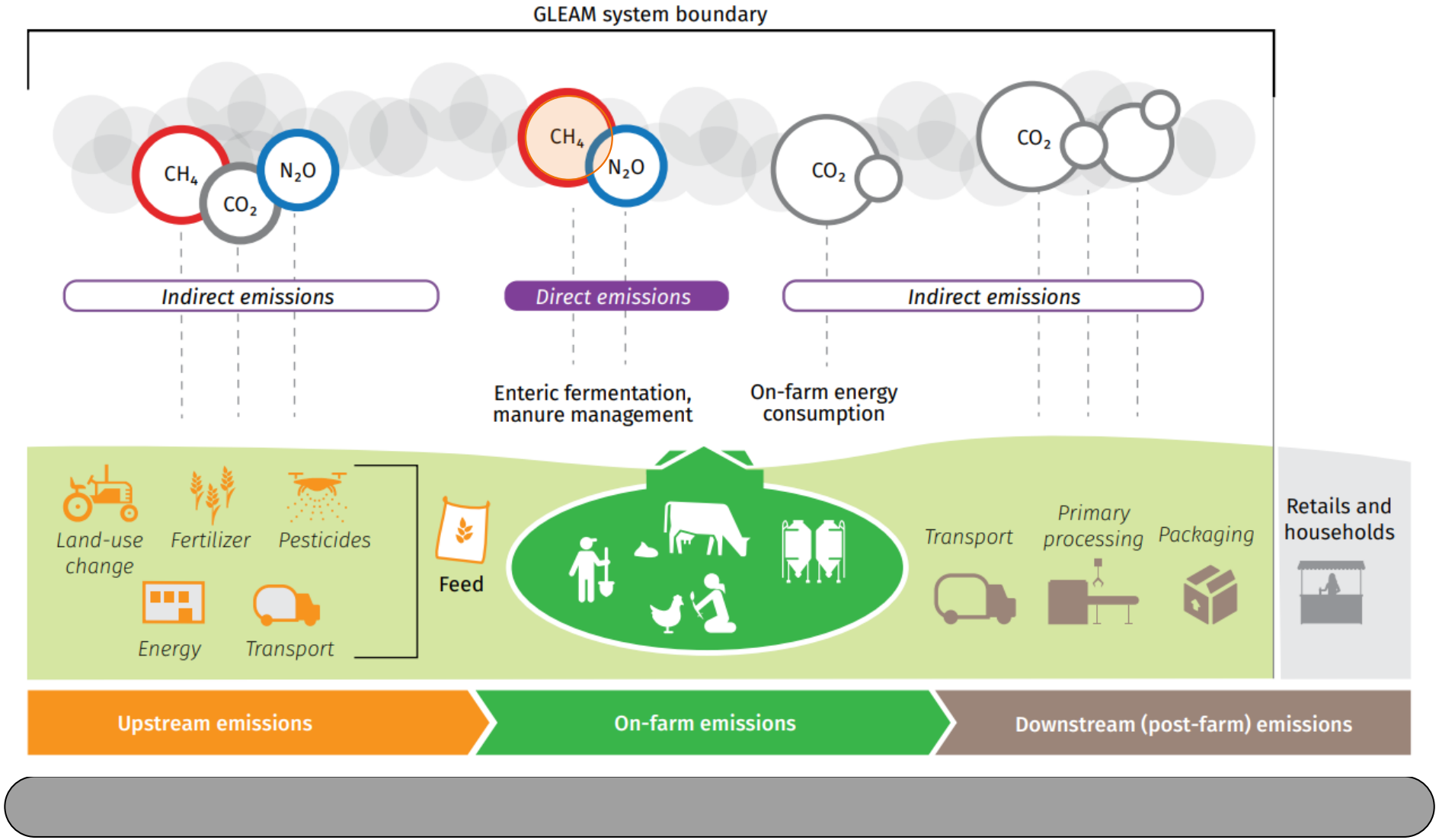

FAO, 2023 – https://doi.org/10.4060/cc9029en

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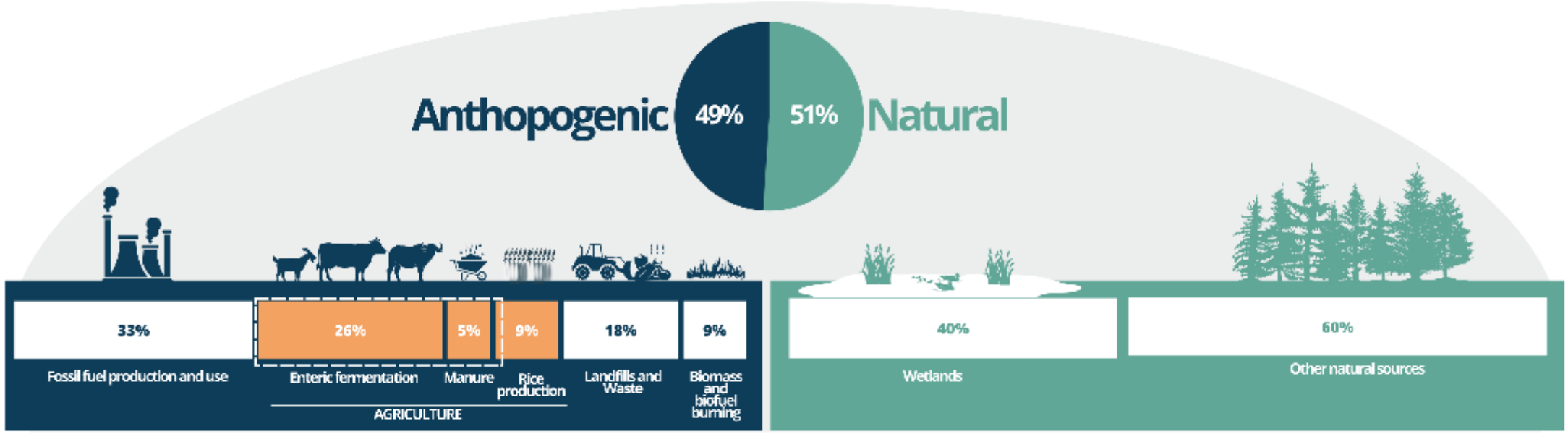
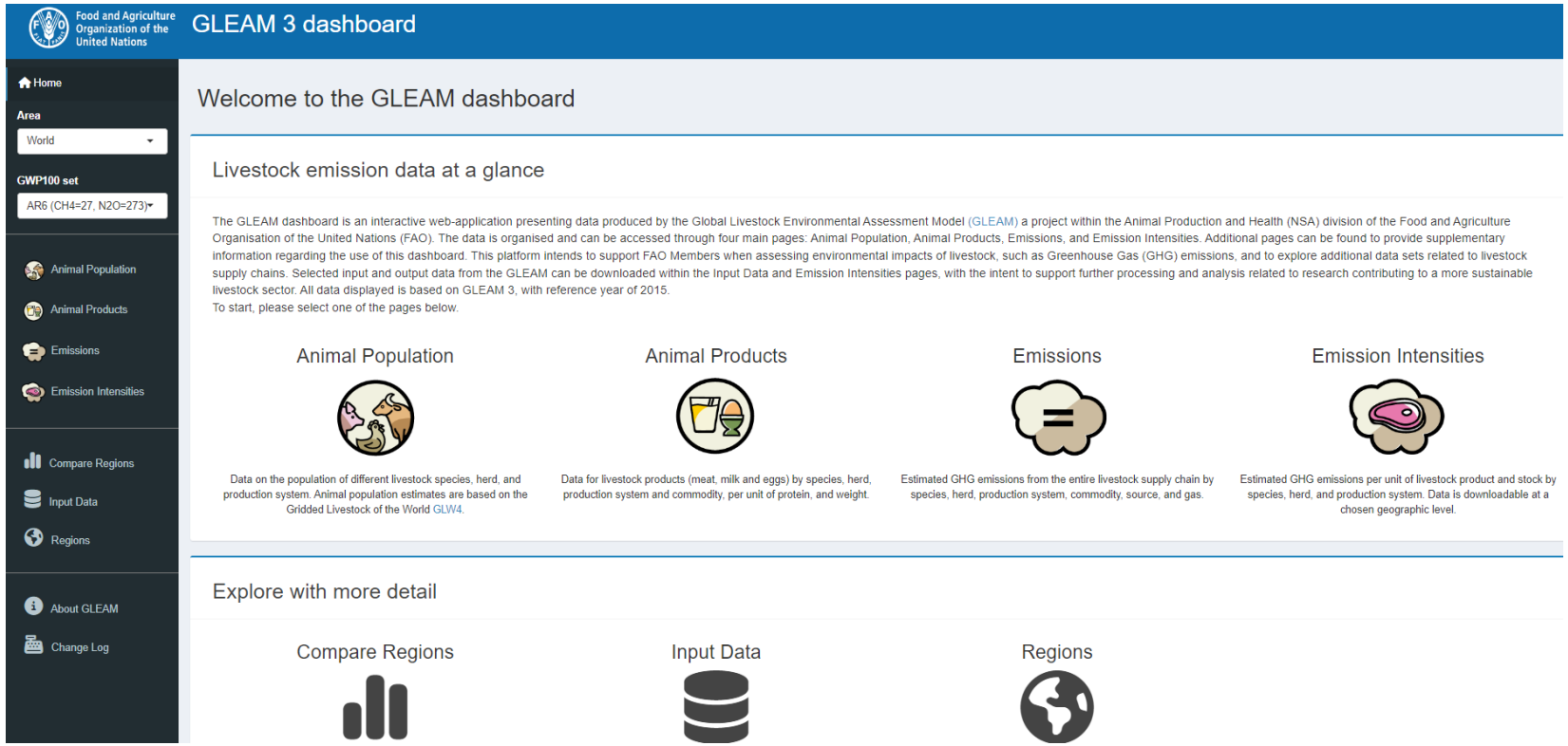
Sources of methane



FAO, 2023 – https://doi.org/10.4060/cc9029en

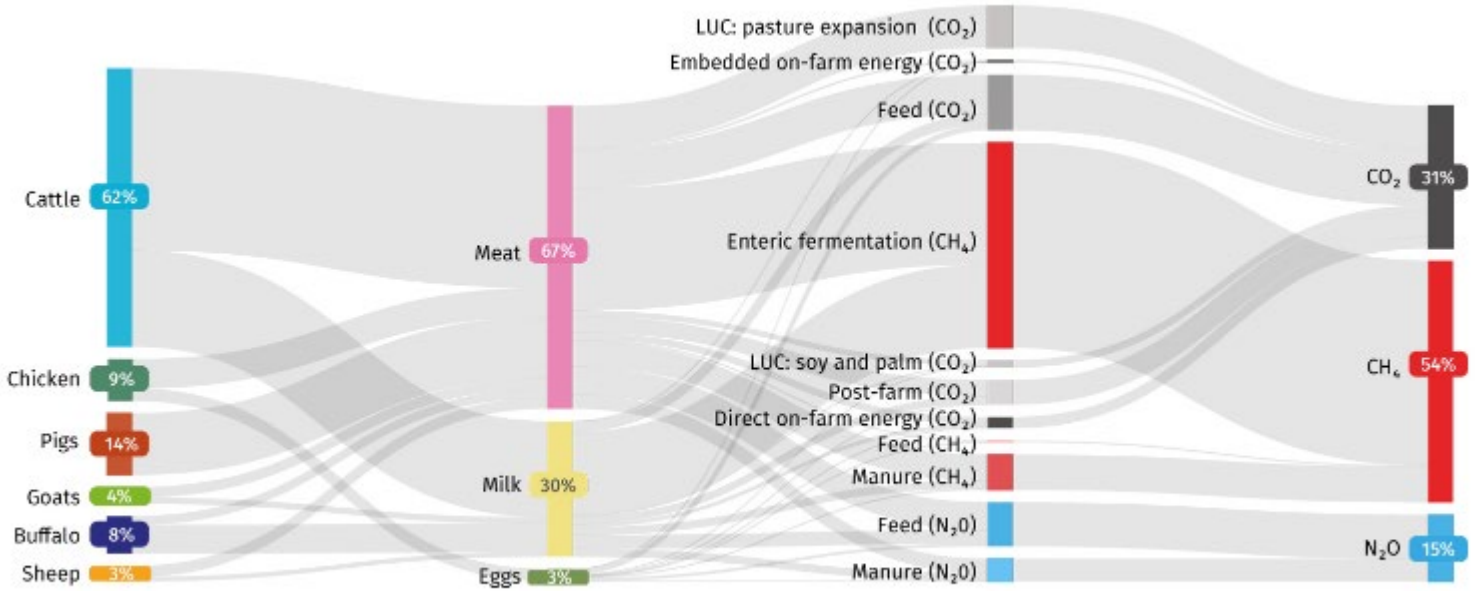
Assessment of GHG emissions

- Global Livestock Environmental Assessment Model (GLEAM)



https://foodandagricultureorganization.shinyapps.io/GLEAMV3_Public/

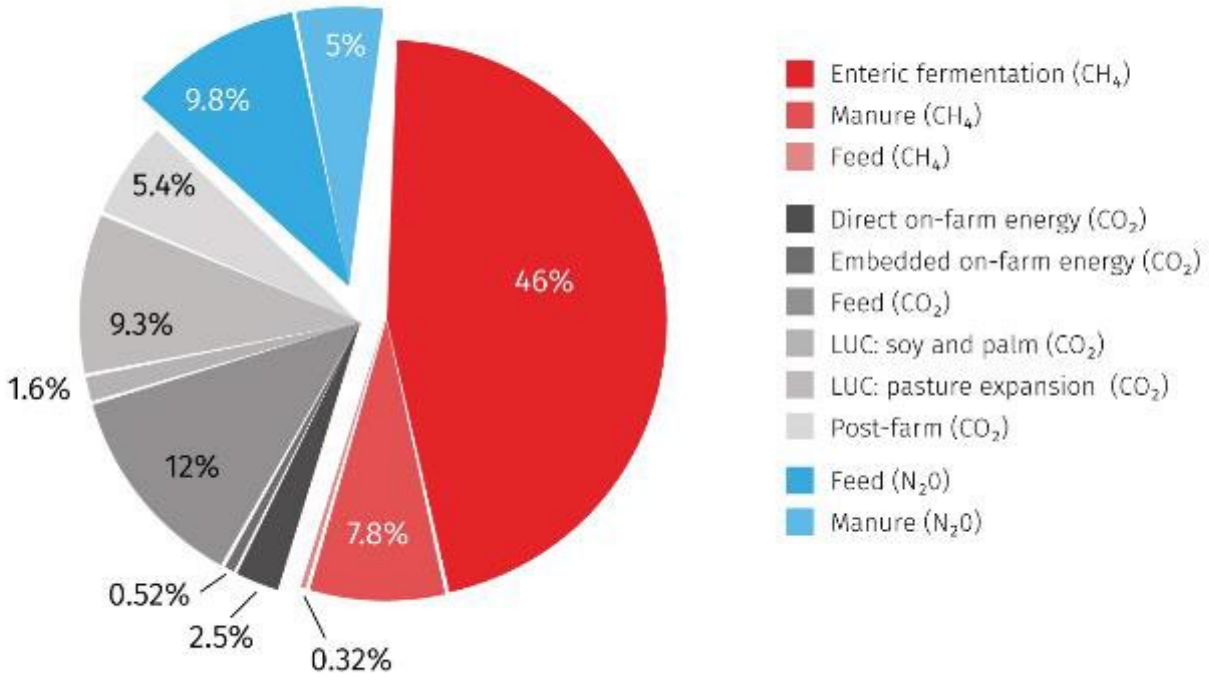
Livestock contributes about 12% to the total GHG emissions



- **Global GHG emissions from livestock: 6.2 Gt CO_2-eq**
- CH_4: 3.3 Gt CO_2-eq (54%)
- Enteric CH_4: 85%
- Manure CH4: 15%

FAO, 2023 – https://doi.org/10.4060/cc9029en

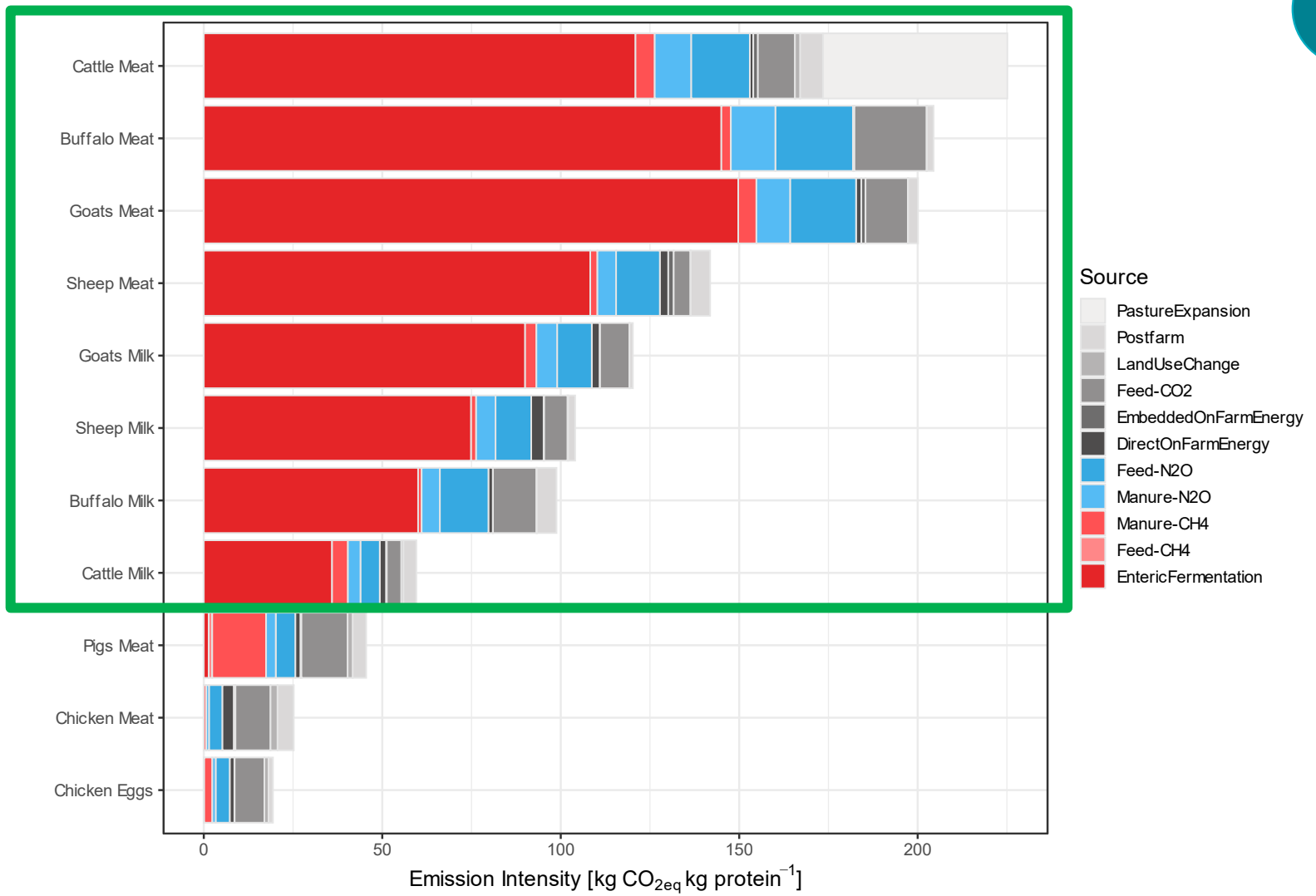
GHG emissions assessment



- **59 percent** of emissions take place on-farm
- **41 percent** of emissions are associated with upstream and downstream processes (feed production and processing)

FAO, 2023 – https://doi.org/10.4060/cc9029en

Emission intensities



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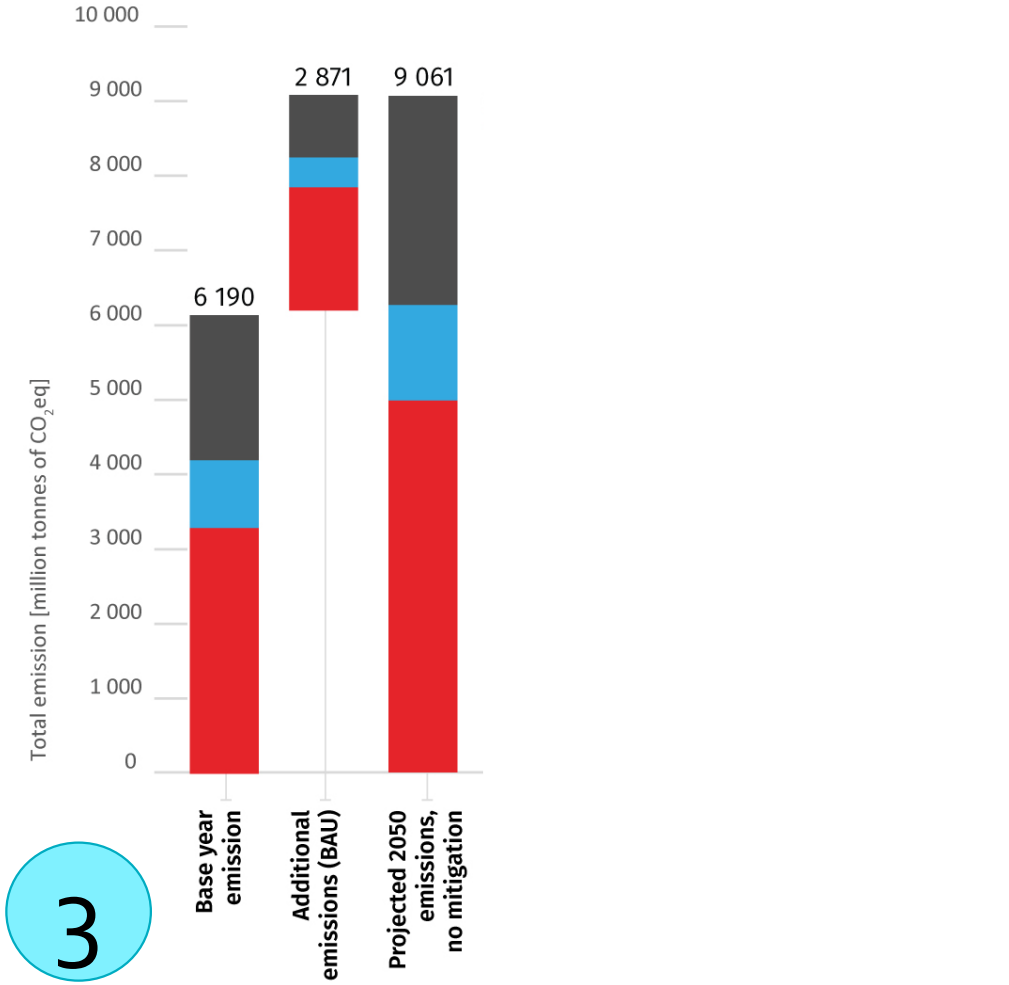
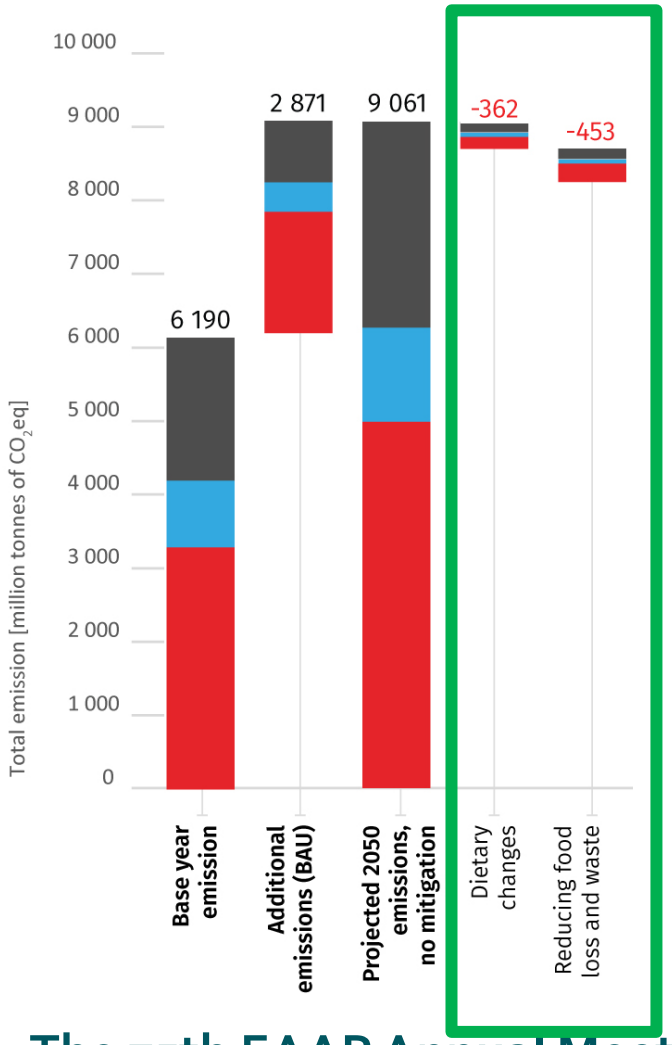
Pathways towards low-emissions



- By 2050, livestock production will increase by **20 percent**, resulting in **46 percent** increase in greenhouse gas emissions under business-as-usual scenario

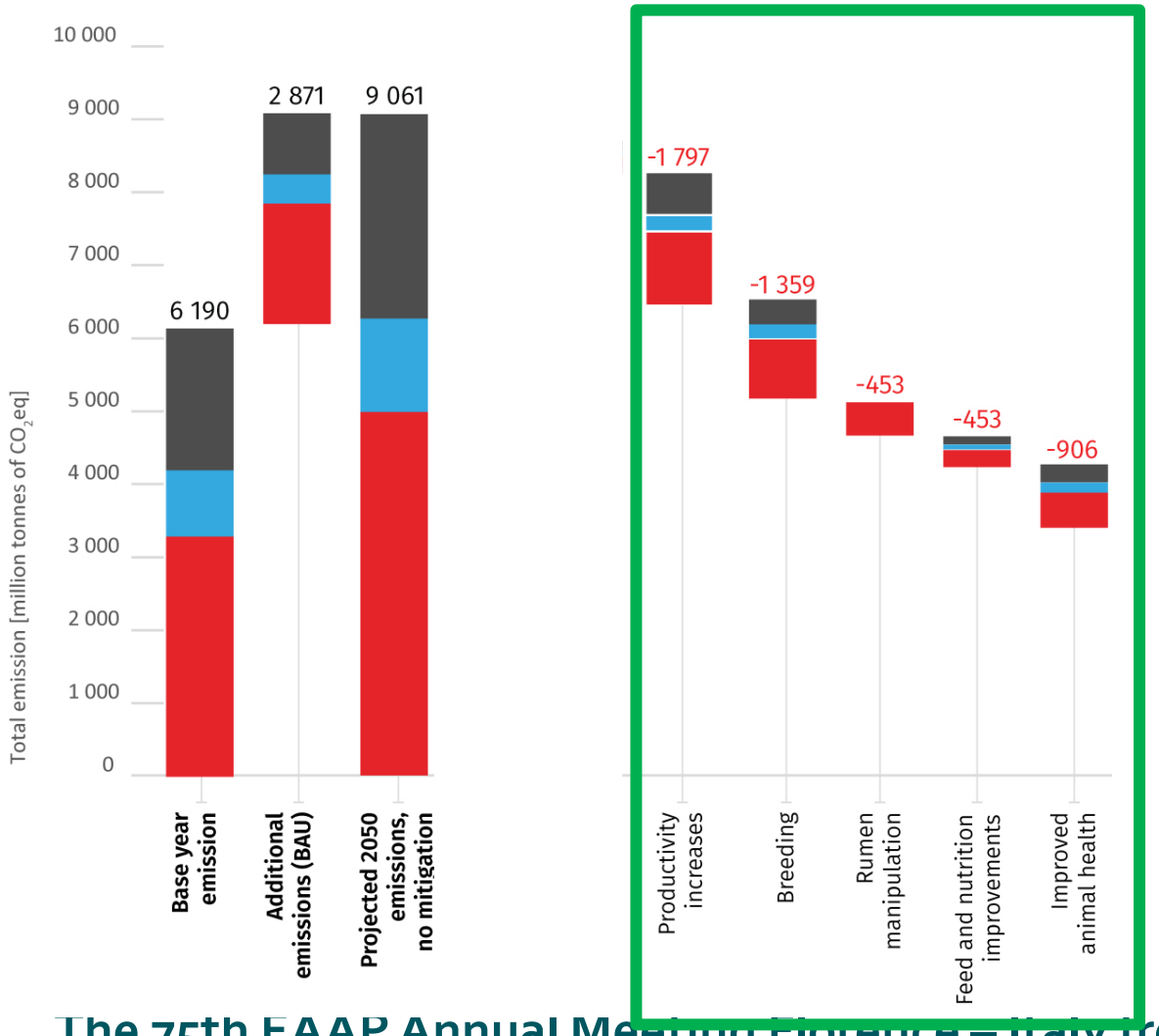
Pathways towards low-emissions



- **Consumer-based mitigation options: 4 – 5 percent**
  - ✓ Dietary Changes
  - ✓ Reducing food loss and wastes

- Dietary changes need to consider nutritional, health and environmental concerns.
- Decrease GHG emissions in HICs
- Increase GHG emissions in LMICs

Pathways towards low-emissions



- **On-farm measures: 5 – 20 percent**
  - ✓ Productivity increase
  - ✓ Breeding
  - ✓ Rumen manipulation
  - ✓ Feed and nutrition improvements
  - ✓ Improved animal health

MITIGATION STRATEGIES FOR METHANE EMISSIONS

3

Strategy	Expected CH_4 decrease range g/day and g/kg meat/milk	Effects on other emissions	Animal productivity	Risks	Potential barriers for on-farm adoption
Increased animal productivity	↑ ↓ to ↓↓	↑↑↑ (UPS, MAN)	↑	0	• Cost/lack of financial incentives • Technical support
Selection of low-CH4 producing animals	↓↓	0	↓/↑	0	• Accessibility, Cost/lack of financial incentives • Resistance to change • Technical support
Levels of feed and Concentrate intake, Concentrate sources, processing	↑ ↓↓	↑↑↑ (UPS, MAN)	↑	S-ANI	• Cost/lack of financial incentives • Technical support
Lipid supplementation	↓↓ ↓ to ↓↓	↑↑↑ (UPS, MAN)	o to ↑	0	• Accessibility, Cost/lack of financial incentives • Technical support
Increased forage digestibility	↑ ↓	↑↓ (UPS, MAN)	↑	0	• Accessibility • Resistance to change • Technical support

MITIGATION STRATEGIES FOR METHANE EMISSIONS

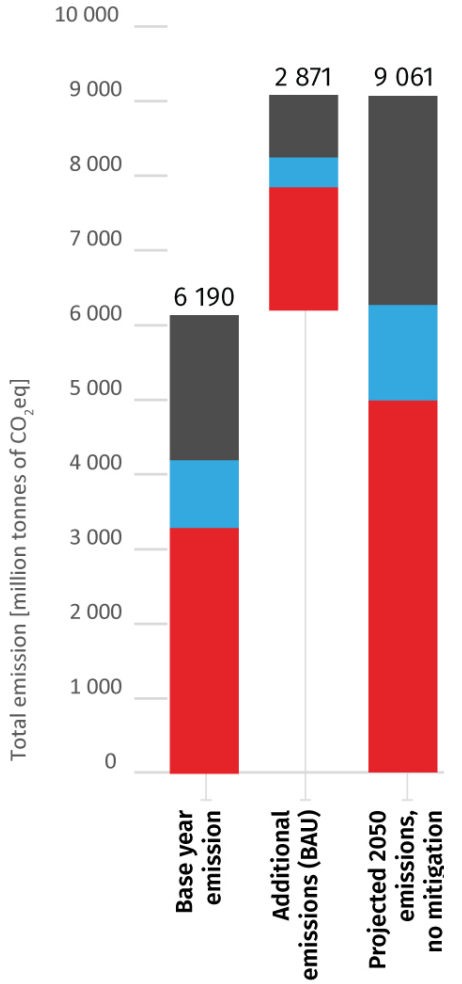
Strategy	Expected CH_4 decrease range g/day and g/kg meat/milk	Effects on other emissions	Animal productivity	Risks	Potential barriers for on-farm adoption
Perennial legumes	↓/↑ ↓/↑	↑↓ (UPS, MAN)	↓/↑	0 S-ANI	• Accessibility • Resistance to change • Technical support
High starch forages	↓ ↓	↑↓ (UPS, MAN)	o to ↑	0	• Accessibility, Cost/lack of financial incentives • Resistance to change • Technical support
Pastures and grazing management	o to ↓ o to ↓	↑↓ (UPS, MAN)	↑	0	• Accessibility, Cost/lack of financial incentives • Resistance to change • Technical support
Preservation and Processing	o to ↑ o to ↓	↑↑↑ (UPS, MAN)	o to ↑	o	• Accessibility • Cost/lack of financial incentives • Technical support
3-Nitrooxypropanol (30%)	↓↓↓ ↓↓↓	↑ (UPS)	↓/↑	MAX	• Accessibility, Cost/lack of financial incentives, • Regulatory approval • Consumer acceptance

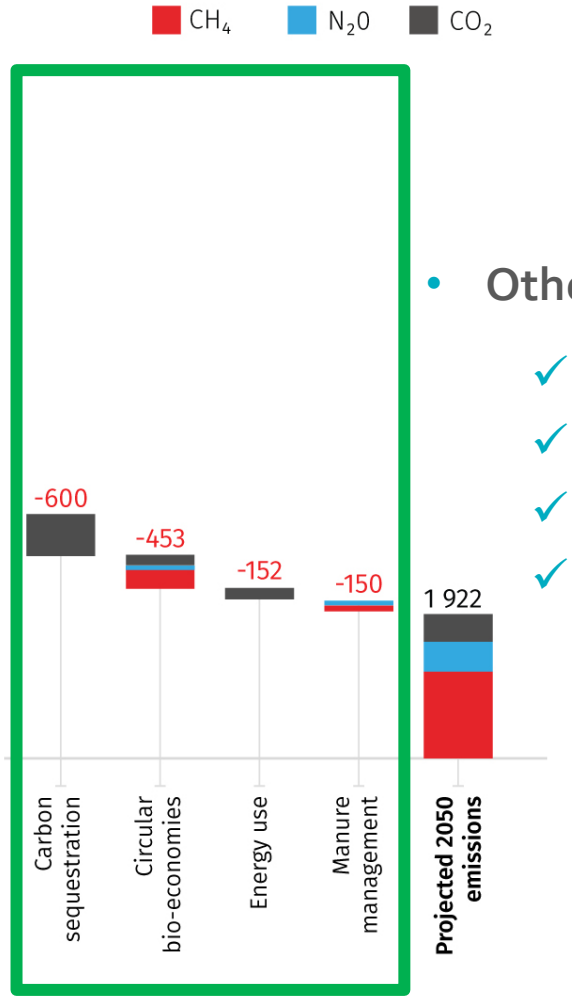
MITIGATION STRATEGIES FOR METHANE EMISSIONS

3

Strategy	Expected CH_4 decrease range g/day and g/kg meat/milk	Effects on other emissions	Animal productivity	Risks	Potential barriers for on-farm adoption
Asparagopsis spp. (40-90%)	↓↓↓ ↓↓↓	↑↓ (UPS, MAN)	↓/↑	MAX, S-ANI S-HUM, S-ENV	• Accessibility, Cost/lack of financial incentives • Regulatory approval • Safety for the animal, the consumer, and the environment
Tannins and saponins	↓ ↓	↑↓ (MAN)	↓/↑	MAX	• Accessibility, Cost/lack of financial incentives • Resistance to change • Technical support
Alternative electron acceptors (nitrate)	? ?	0 to ↑↑↑ (UPS, ANI, MAN)	↓	MAX, S-ANI	• Accessibility, Cost/lack of financial incentives • Resistance to change • Technical support

Pathways towards low-emissions

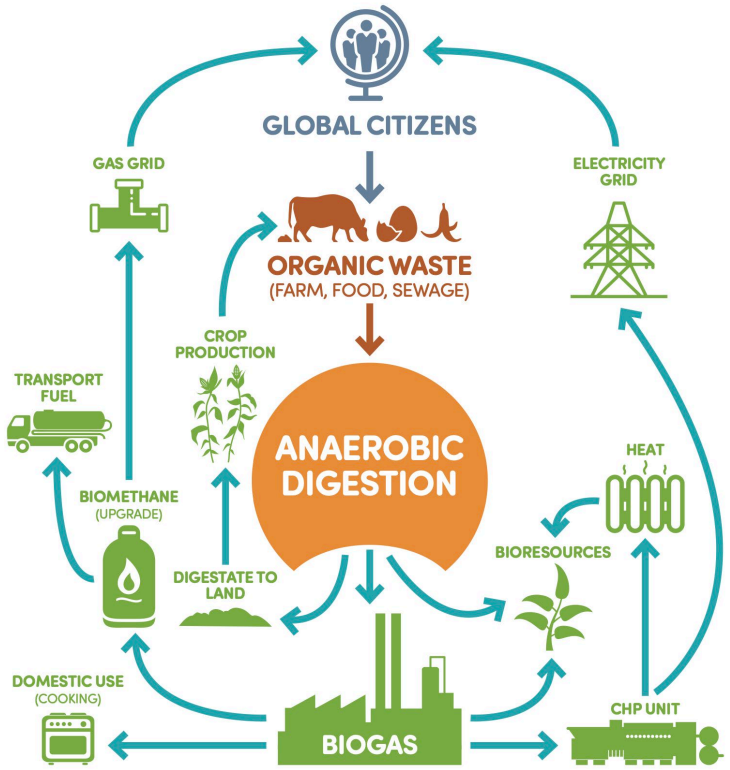




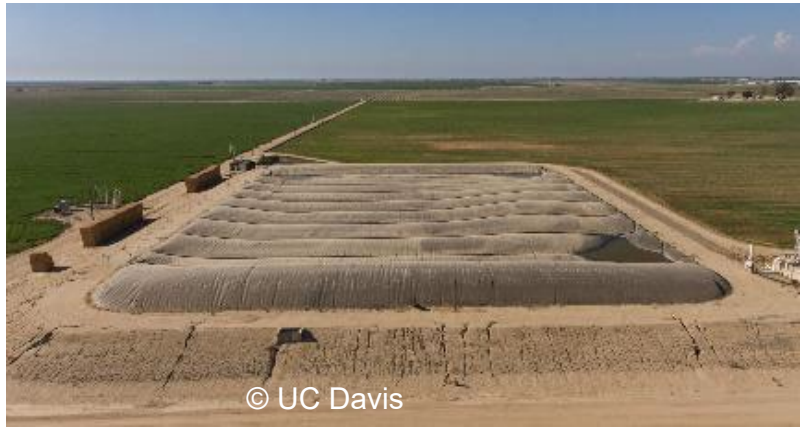
- **Other solutions: 1.6 – 6.6 percent**
  - ✓ Carbon sequestration
  - ✓ Circular bio-economy
  - ✓ Energy use
  - ✓ Manure management

Anaerobic digestion - MMS

- **Housing, manure storage and land application**
  - ✓ Biogas
  - ✓ Decreasing manure storage T◦
  - ✓ Manure acidification
  - ✓ Solids separation
  - ✓ Composting



worldbiogasassociation.org



FAO, 2023. https://doi.org/10.4060/cc7607en

FAO's work to reduce methane emissions

- Integration of livestock-related mitigation and adaptation targets in NDCs
- Capacity building and knowledge transfer
- Climate finance
- Development of national methane roadmap and policies for the livestock sector
- Sustainable Livestock Transformation Framework

https://www.fao.org/in-action/enteric-methane/en

How? A roadmap for success

Building a more sustainable, efficient, inclusive, and resilient livestock sector for all

SUSTAINABLE DEVELOPMENT GOALS

Sustainable Livestock Transformation Framework

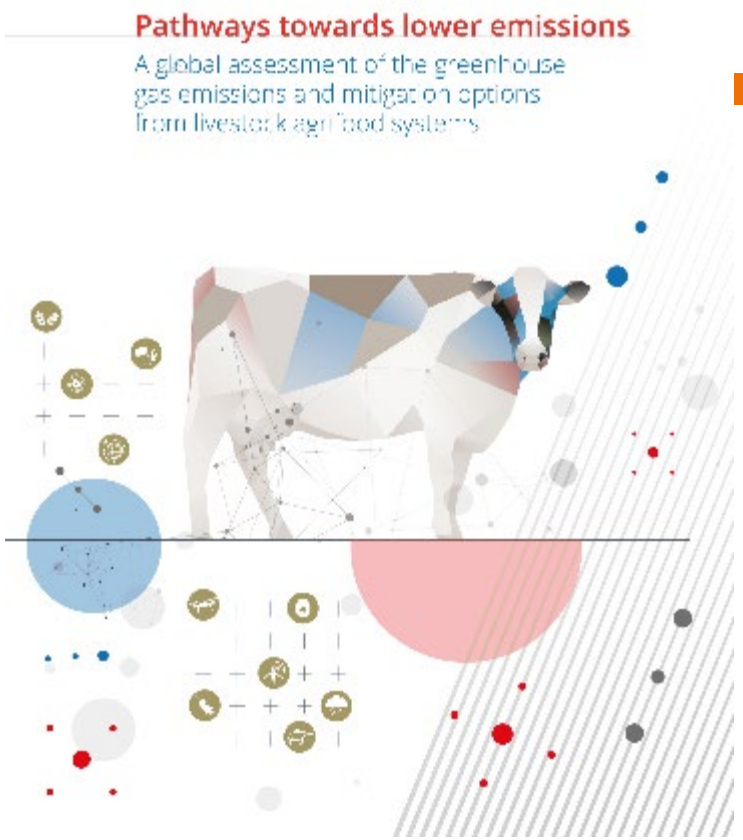
1.	2.	3.	4.	5.
Building science and evidence-based narratives and visions for Sustainable Livestock Transformation	**Promoting the adoption of tailored and context-specific good practices***	**Promoting and implementing policy and responsible investment for impact at scale**	Accelerating sustainable transformation of livestock sector through greater cooperation, partnership and innovation	**Taking a holistic approach that considers the multiple** sustainability dimensions of livestock systems throughout the entire value chain

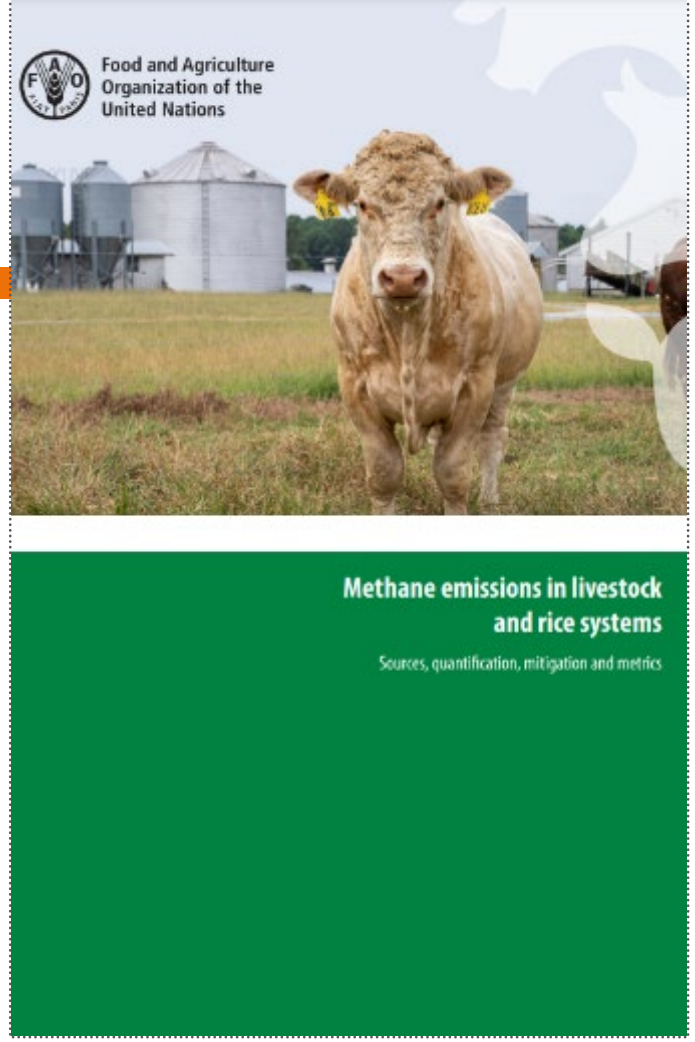
"Outcome" = actors along the value chain share and adopt good practices "Impact" = better production, better nutrition, better environment and a better life

Key messages

- Livestock systems collectively contribute to 6.2 Gt CO_2eq emissions, constituting approximately 12 percent of all anthropogenic GHG emissions in 2015.
- The adoption of technical and innovative interventions on both the supply and the demand sides of animal production has the potential to reduce of GHG emissions

- More climate finance is needed to address the sources of GHG emissions in the livestock sector, in particular, methane
- Livestock systems can be part of the solutions to climate change and other environmental crisis


Food and Agriculture Organization of the United Nations
Pathways towards lower emissions
A global assessment of the greenhouse gas emissions and mitigation options from livestock agri-food systems


Food and Agriculture Organization of the United Nations
Methane emissions in livestock and rice systems
Sources, quantification, mitigation and metrics

Acknowledgements

FAO team: Dominik Wisser, Şeyda Özkan, Lydia Lanzoni, Giuseppe Tempio, Francesco N. Tubiello, Aimable Uwizeye, Carolina Lizarralde Piquet, Giuseppina Cinardi, Saskia Reppin, Marta Dondini, Timothy Robinson, and Monica Rulli

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