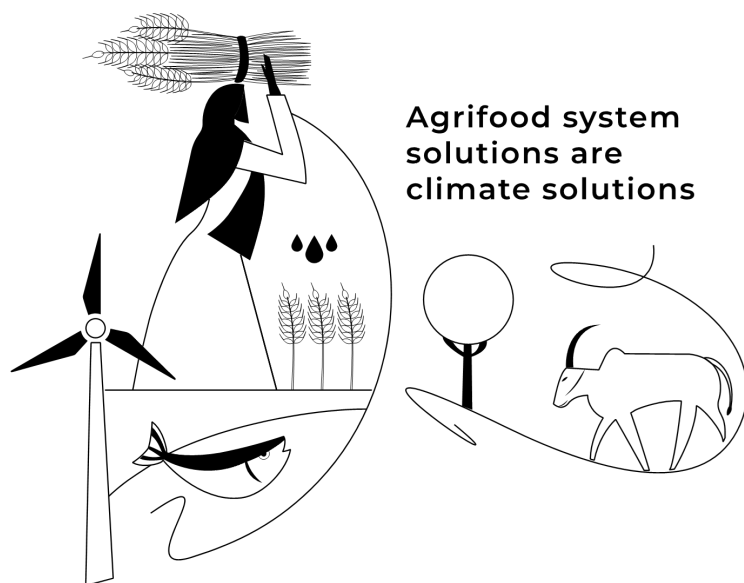




Session 8o. Technologies for GHG emission mitigation on farm: options, opportunities and challenges

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

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1

Trends in
global
livestock
systems



2

Greenhouse
gas
emissions
from
Livestock
systems



3

Pathways
towards
lower
emissions

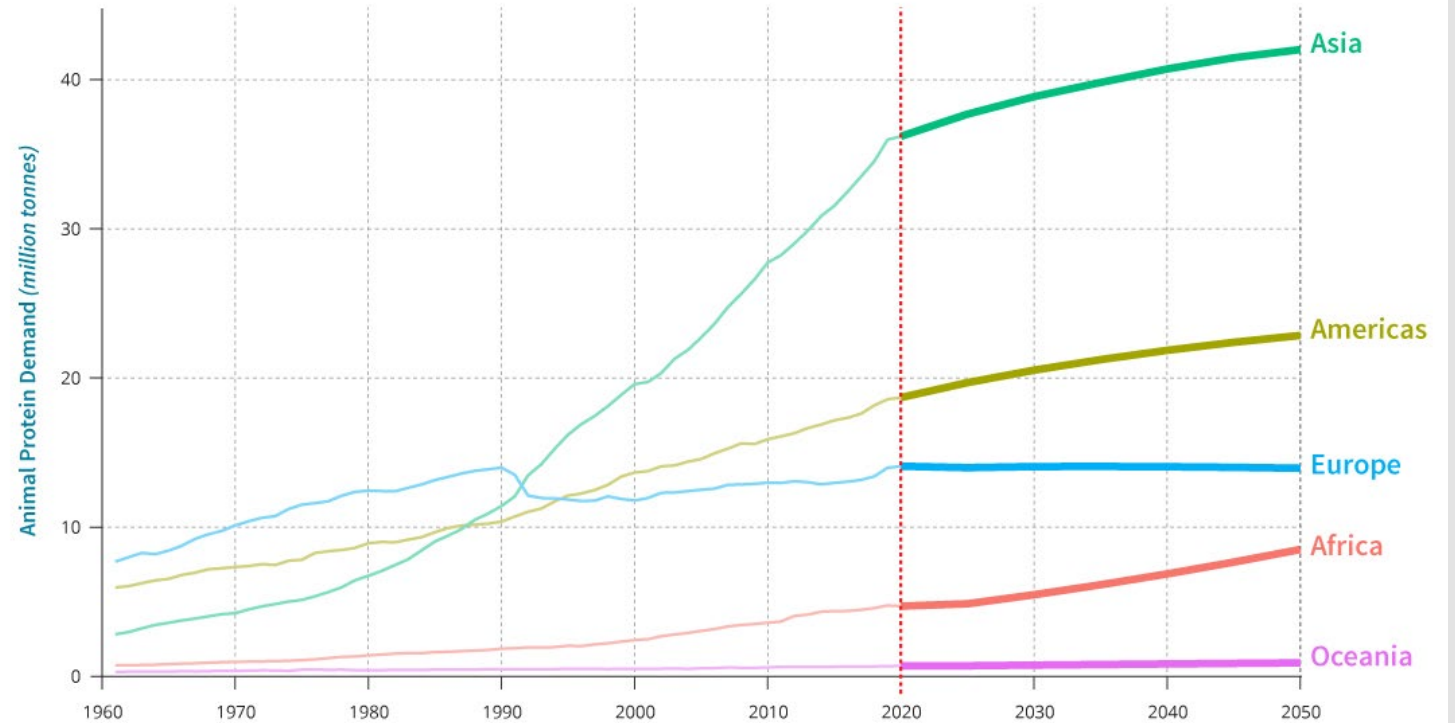


4

FAO's work
on livestock
climate
action



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



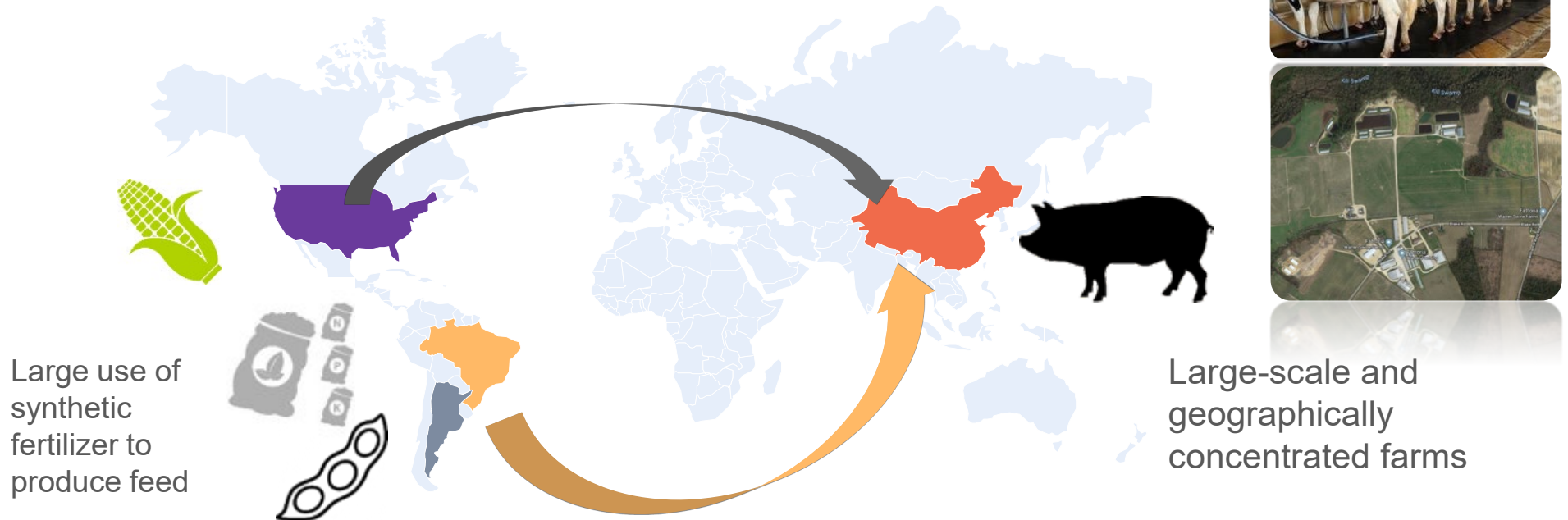
FAO, 2023 – <https://doi.org/10.4060/cc9029en>

Disconnection between feed and livestock



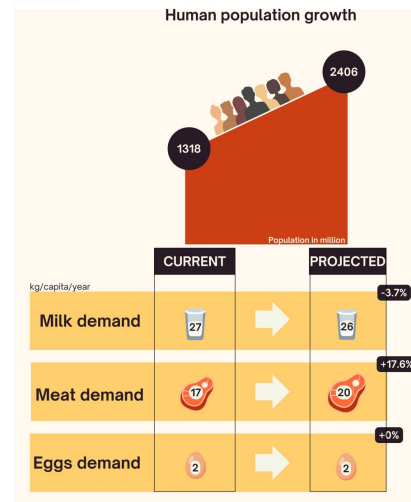
Small-scale farms

Disconnection between feed production and animal production

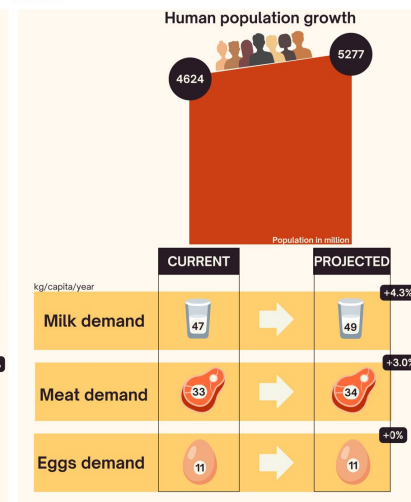


Trends in global livestock systems

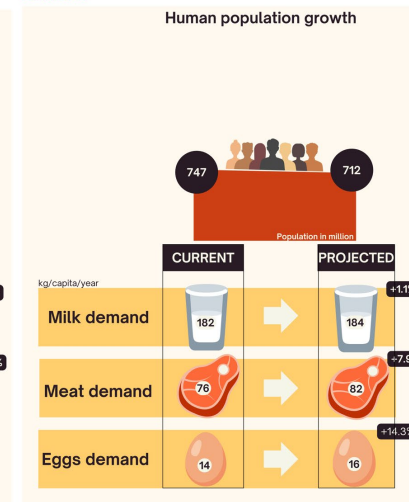
AFRICA



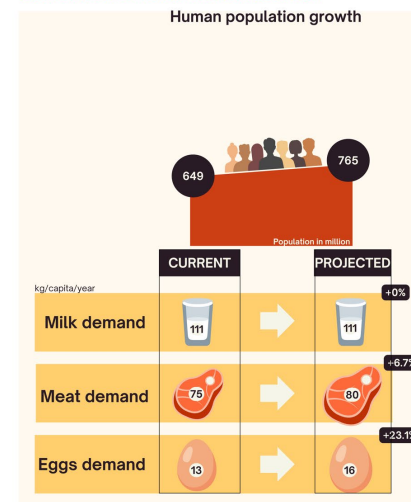
ASIA



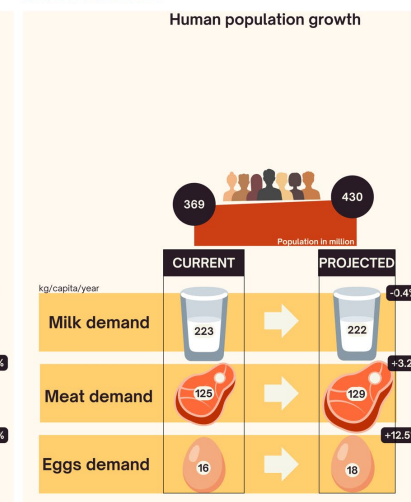
EUROPE



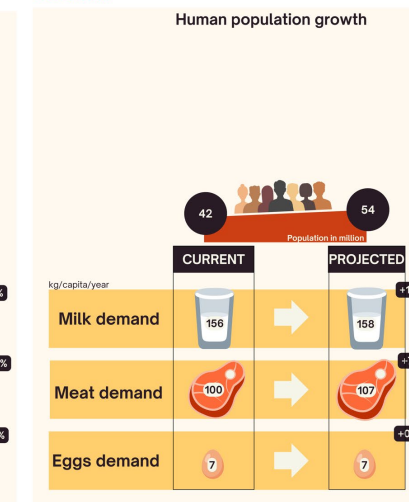
LATIN AMERICA AND THE CARIBBEAN



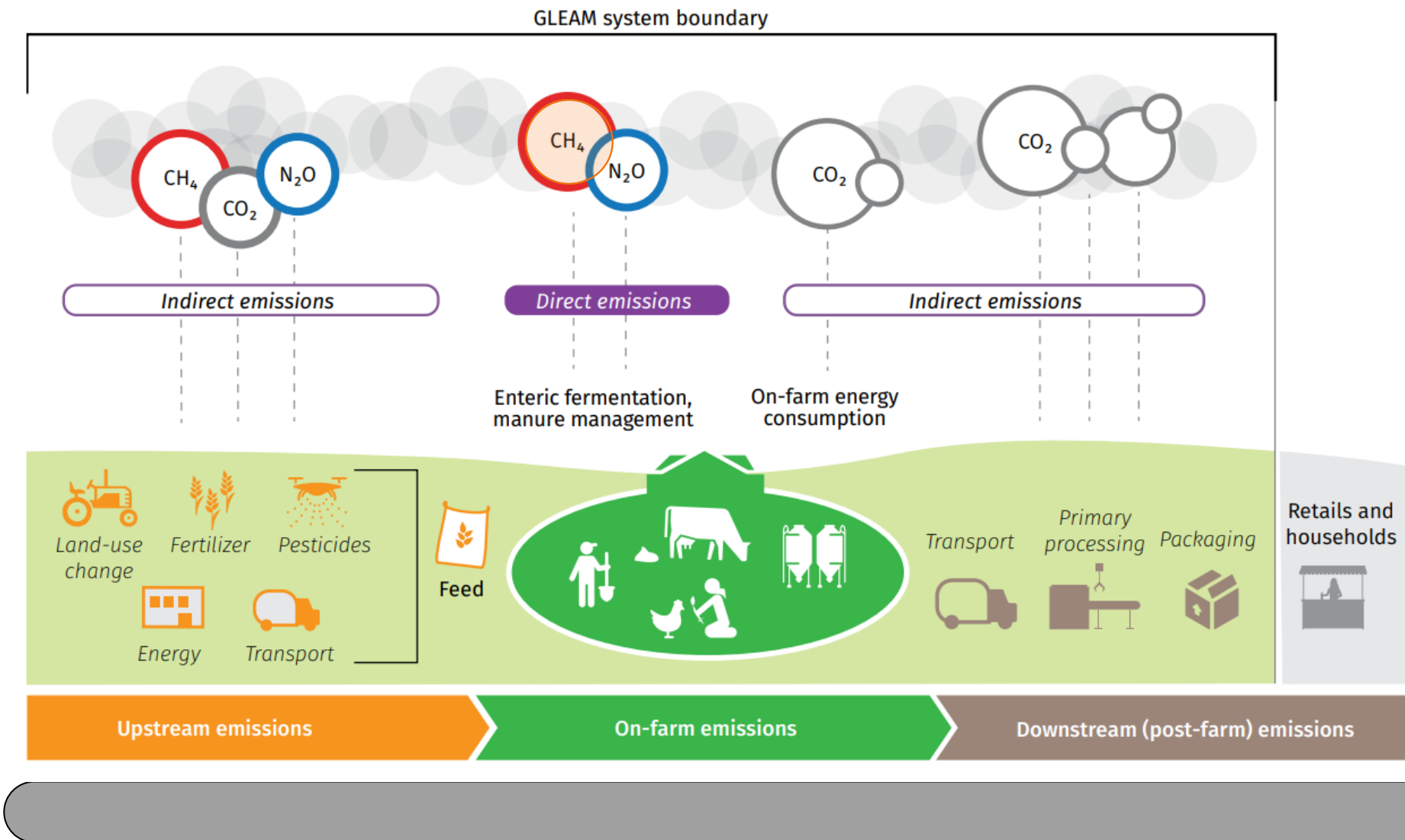
NORTH AMERICA



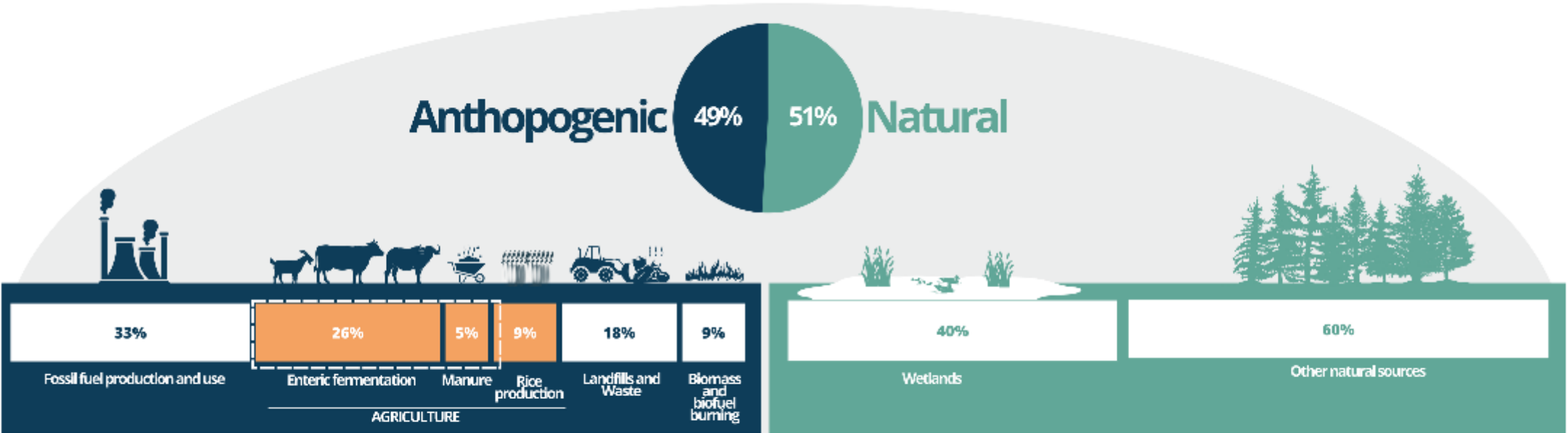
OCEANIA



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



Sources of methane



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

Assessment of GHG emissions

- Global Livestock Environmental Assessment Model (GLEAM)

The screenshot shows the GLEAM 3 dashboard. At the top, the FAO logo and 'Food and Agriculture Organization of the United Nations' are on the left, and 'GLEAM 3 dashboard' is on the right. Below the header, a sidebar on the left contains navigation links: Home, Area (set to World), GWP100 set (set to AR6 (CH4=27, N2O=273)), Animal Population, Animal Products, Emissions, Emission Intensities, Compare Regions, Input Data, Regions, About GLEAM, and Change Log. The main content area has a welcome message and a section titled 'Livestock emission data at a glance'. This section includes a paragraph explaining the dashboard's purpose and a row of four icons with descriptions: Animal Population (cows and sheep), Animal Products (milk and eggs), Emissions (cloud with equals sign), and Emission Intensities (cloud with cow). Below this, an 'Explore with more detail' section features three icons: Compare Regions (bar chart), Input Data (database cylinder), and Regions (globe).

Food and Agriculture Organization of the United Nations

GLEAM 3 dashboard

Welcome to the GLEAM dashboard

Livestock emission data at a glance

The GLEAM dashboard is an interactive web-application presenting data produced by the Global Livestock Environmental Assessment Model (GLEAM) a project within the Animal Production and Health (NSA) division of the Food and Agriculture Organisation of the United Nations (FAO). The data is organised and can be accessed through four main pages: Animal Population, Animal Products, Emissions, and Emission Intensities. Additional pages can be found to provide supplementary information regarding the use of this dashboard. This platform intends to support FAO Members when assessing environmental impacts of livestock, such as Greenhouse Gas (GHG) emissions, and to explore additional data sets related to livestock supply chains. Selected input and output data from the GLEAM can be downloaded within the Input Data and Emission Intensities pages, with the intent to support further processing and analysis related to research contributing to a more sustainable livestock sector. All data displayed is based on GLEAM 3, with reference year of 2015. To start, please select one of the pages below.

Animal Population

Data on the population of different livestock species, herd, and production system. Animal population estimates are based on the Gridded Livestock of the World GLW4.

Animal Products

Data for livestock products (meat, milk and eggs) by species, herd, production system and commodity, per unit of protein, and weight.

Emissions

Estimated GHG emissions from the entire livestock supply chain by species, herd, production system, commodity, source, and gas.

Emission Intensities

Estimated GHG emissions per unit of livestock product and stock by species, herd, and production system. Data is downloadable at a chosen geographic level.

Explore with more detail

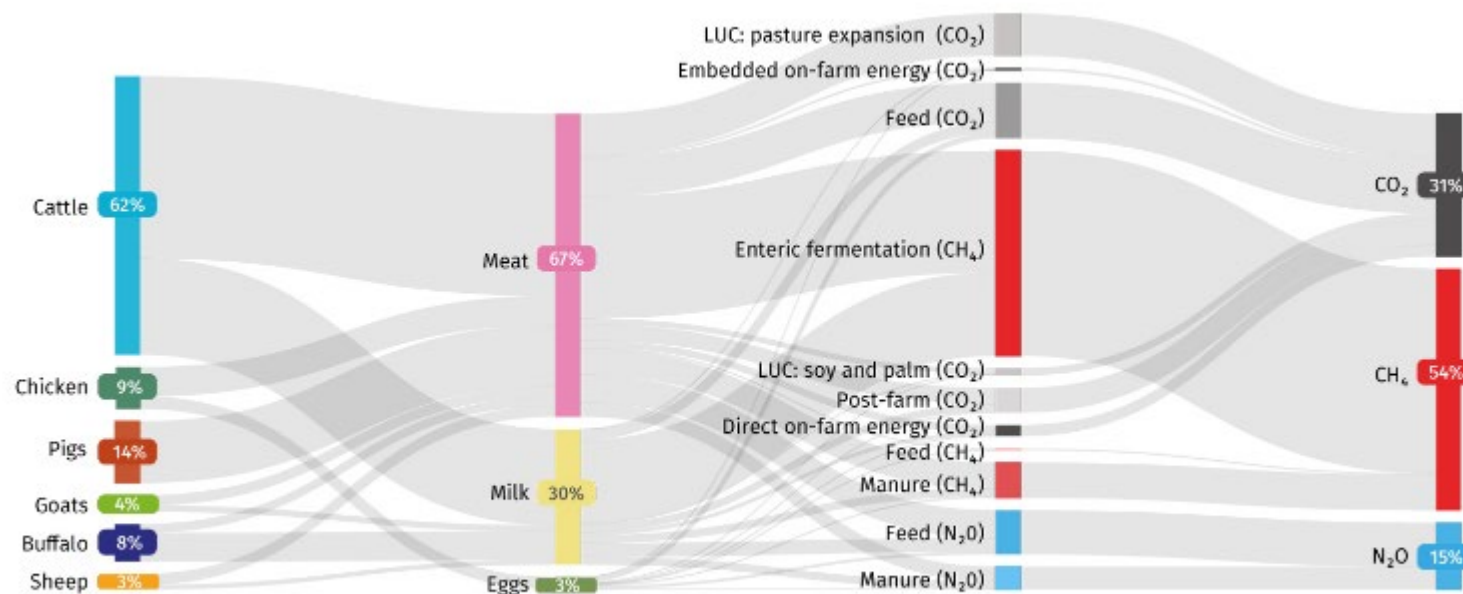
Compare Regions

Input Data

Regions

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

Livestock contributes about 12% to the total GHG emissions



Global GHG emissions from livestock: 6.2 Gt CO₂-eq

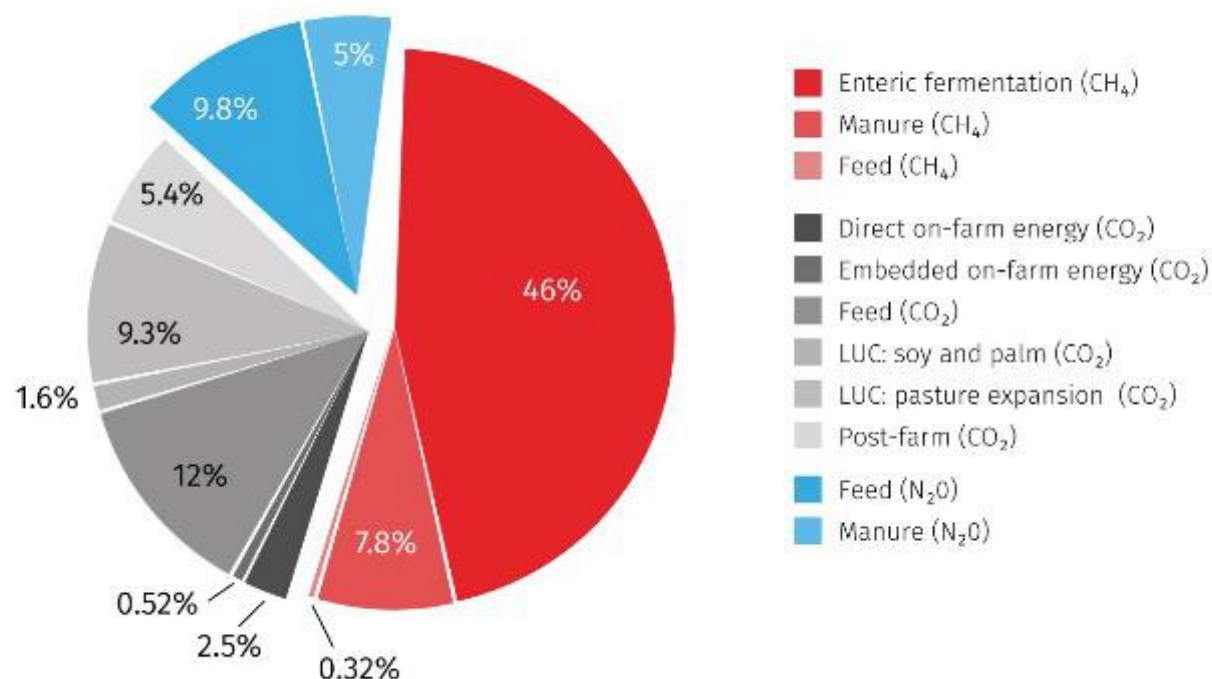
CH₄: 3.3 Gt CO₂-eq (54%)

Enteric CH₄: 85%

Manure CH₄: 15%



GHG emissions assessment

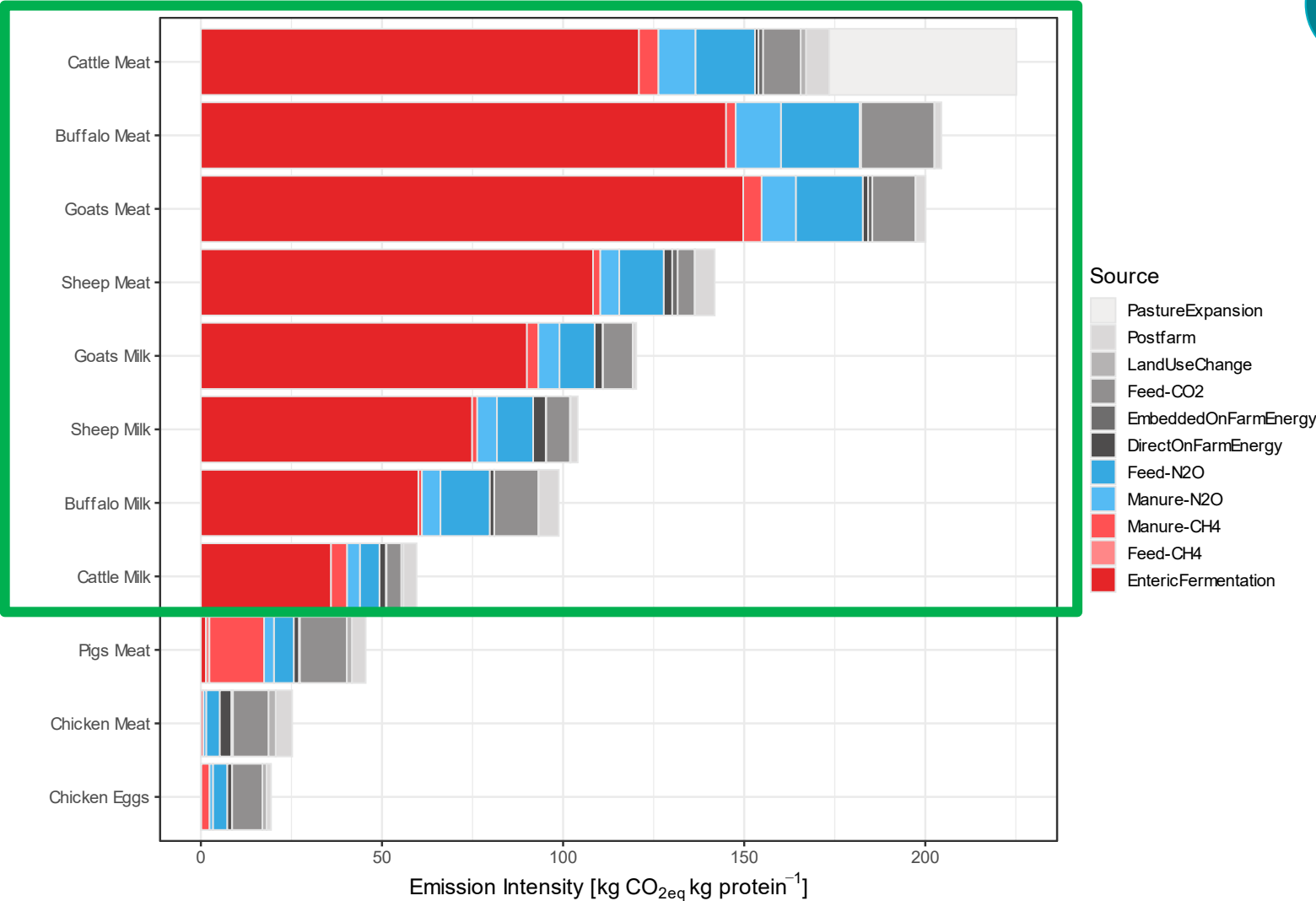


 **59 percent** of emissions take place on-farm

 **41 percent** of emissions are associated with upstream and downstream processes (feed production and processing)

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

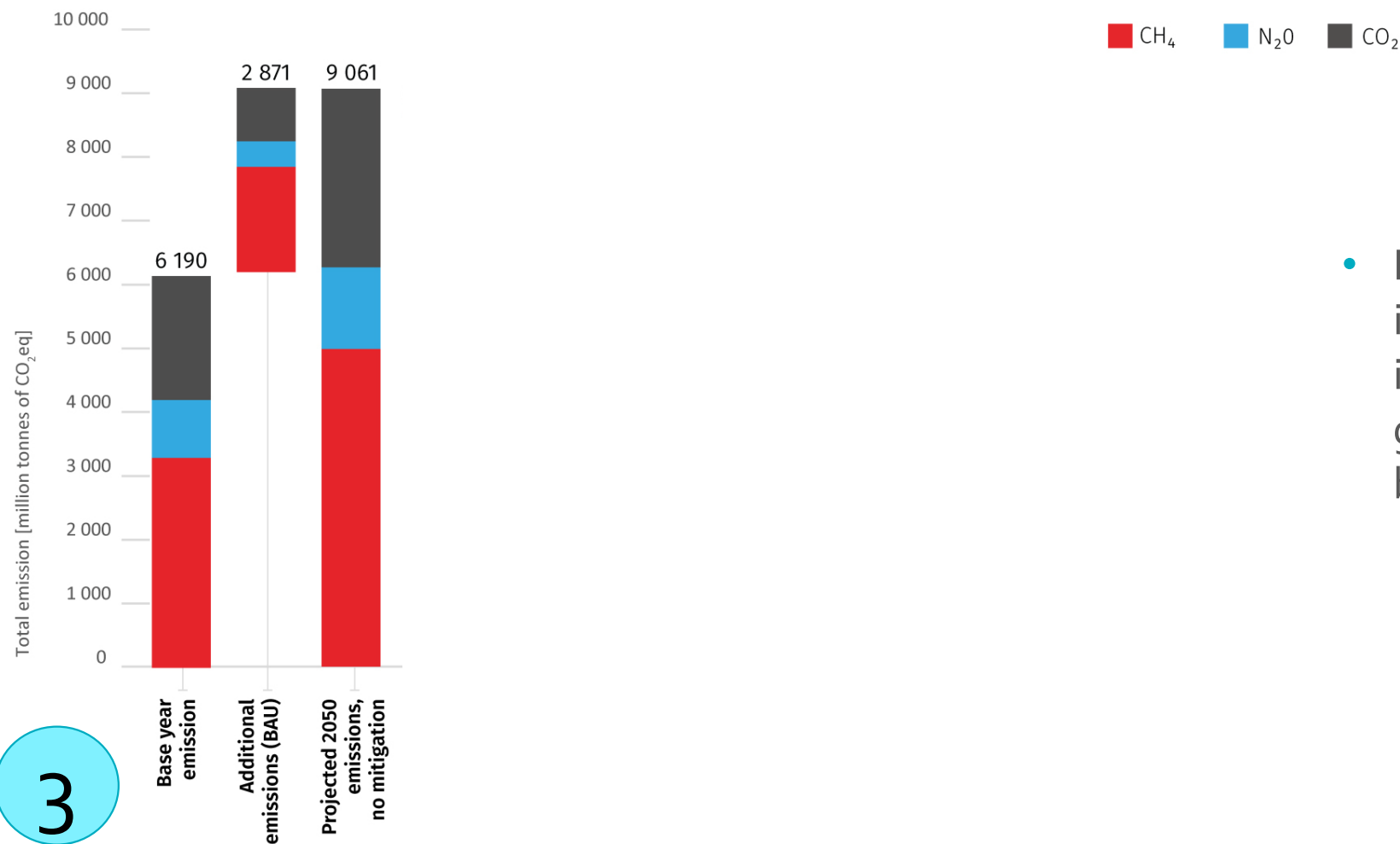
Emission intensities



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



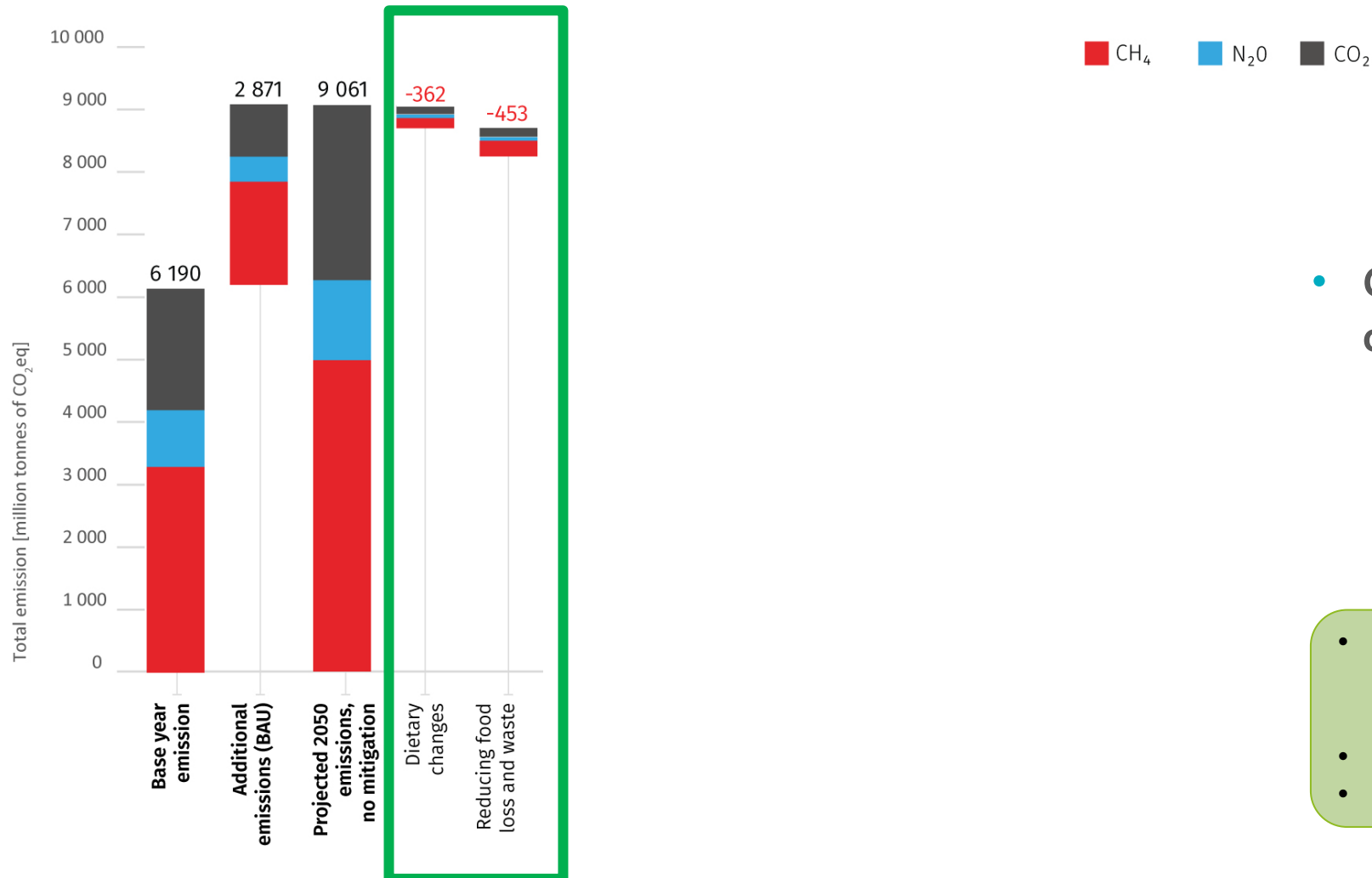
Pathways towards low-emissions



- 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



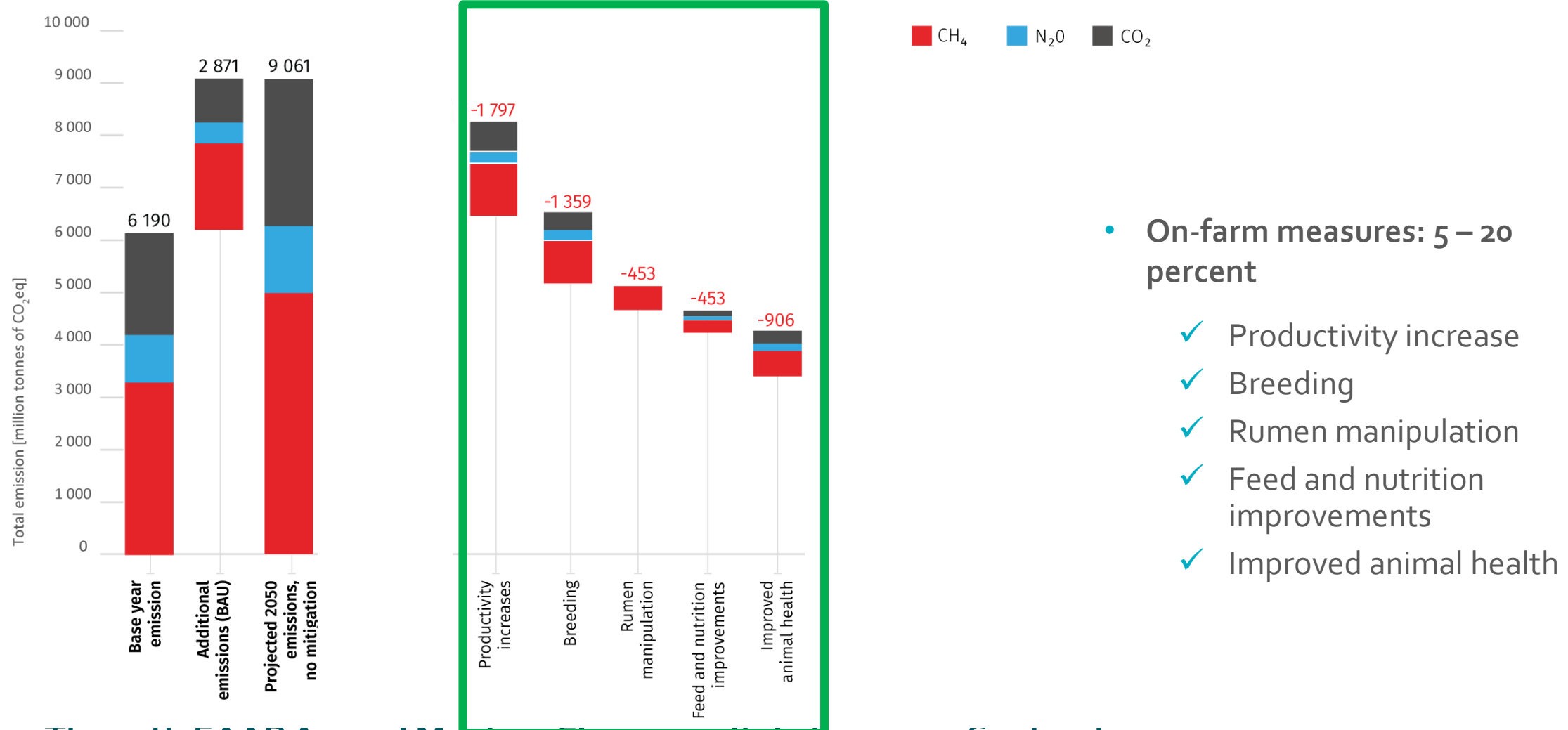
- Consumer-based mitigation options: 4 – 5 percent

- ✓ 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



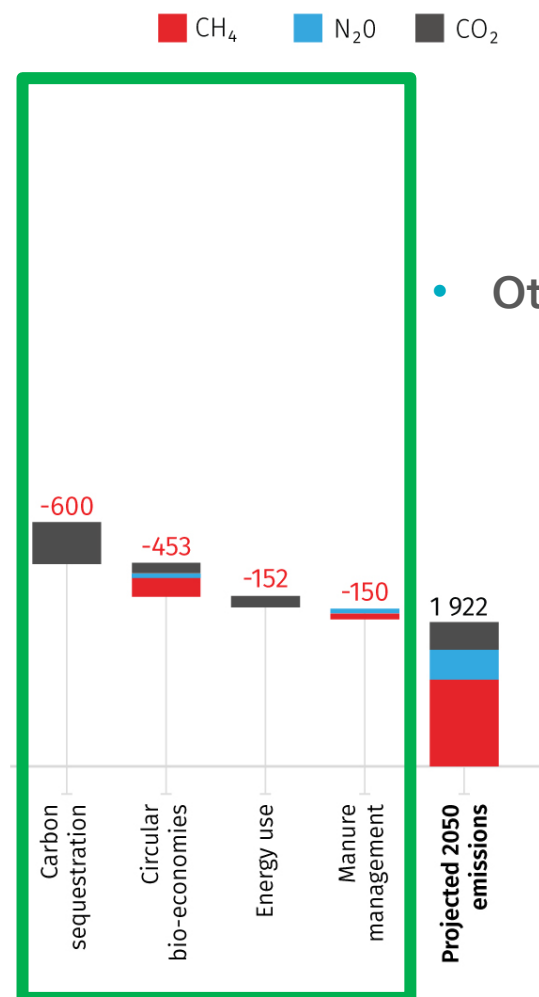
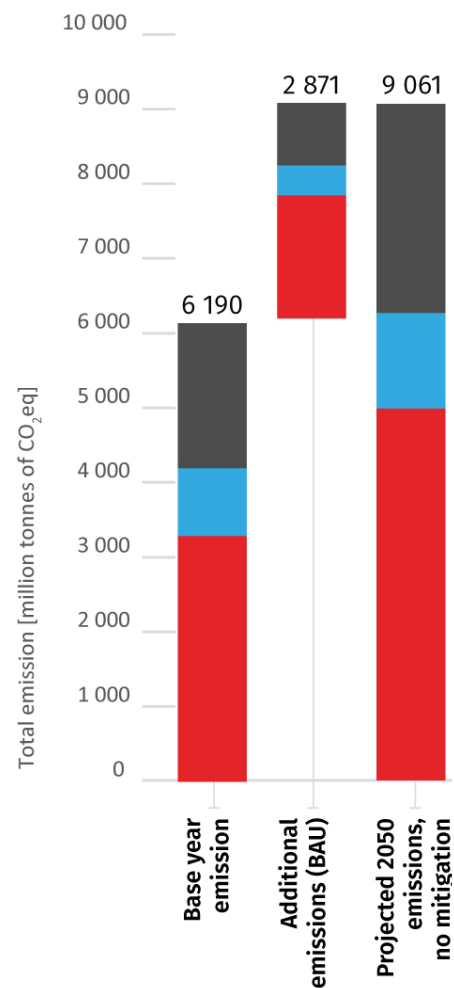
Strategy	Expected CH ₄ decrease range g/day and g/kg meat/milk	Effects on other emissions	Animal productivity	Risks	Potential barriers for on-farm adoption
Increased animal productivity	↑ ↓ to ↓↓	↑↑↑ (UPS, MAN)	↑	0	• Cost/lack of financial incentives • Technical support
Selection of low-CH ₄ producing 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)	0 to ↑	0	• Accessibility, Cost/lack of financial incentives • Technical support
Increased forage digestibility	↑ ↓	↑↓ (UPS, MAN)	↑	0	• Accessibility • Resistance to change • Technical support

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 ↗	0	• Accessibility • Cost/lack of financial incentives • Technical support
3-Nitrooxypropanol (30%)	↓↓↓ ↓↓↓	↗ (UPS)	↕/↗	MAX	• Accessibility, Cost/lack of financial incentives, • Regulatory approval • Consumer acceptance

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
<i>Asparagopsis</i> 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

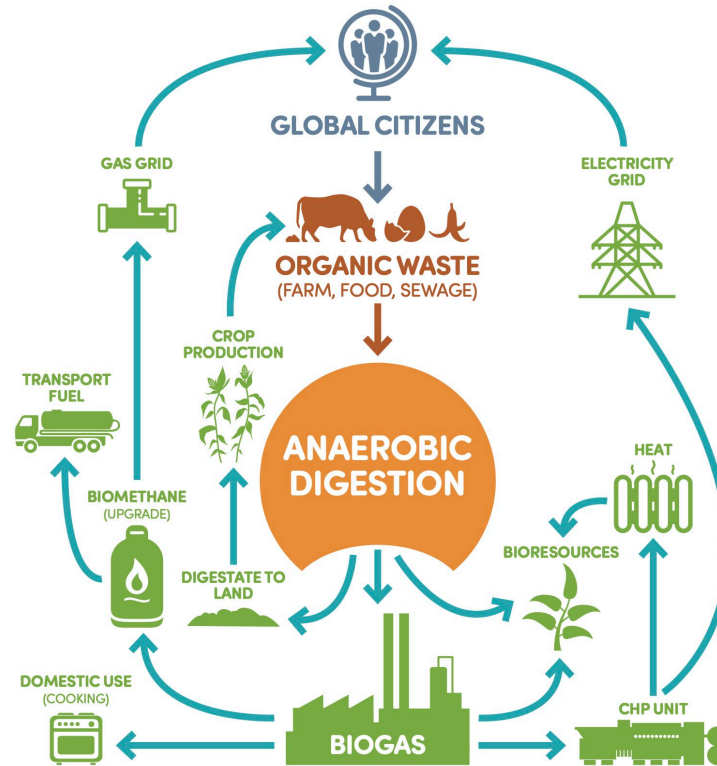


- Other solutions: 1.6 – 6.6 percent

- ✓ Carbon sequestration
- ✓ Circular bio-economy
- ✓ Energy use
- ✓ Manure management

Anaerobic digestion - MMS

- Housing, manure storage and land application
 - ✓ Biogas
 - ✓ Decreasing manure storage T₀
 - ✓ Manure acidification
 - ✓ Solids separation
 - ✓ Composting





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



How? A roadmap for success



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



Sustainable Livestock Transformation Framework

1.

Building science and
evidence-based
narratives and visions for
Sustainable Livestock
Transformation

2.

Promoting the adoption
of tailored and context-
specific good practices*

3.

Promoting and
implementing policy and
responsible investment
for impact at scale

4.

Accelerating sustainable
transformation of
livestock sector through
greater cooperation,
partnership and
innovation

5.

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

The 75th EAAP Annual Meeting Florence – Italy from 1 - 5 September 2024

Key messages



(c) Omar Ramadan, pexels.com

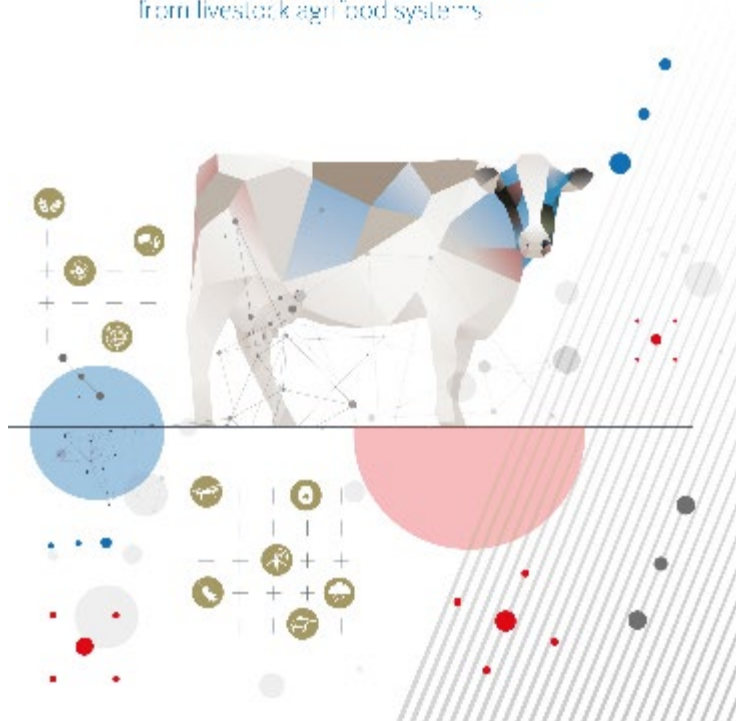
- Livestock systems collectively contribute to 6.2 Gt CO₂e emissions, constituting approximately 12 percent of all anthropogenic GHG emissions in 2015.
- The adoption of technical and innovative interventions on both the supply and the demand sides of animal production has the potential to reduce of 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

Pathways towards lower emissions

A global assessment of the greenhouse
gas emissions and mitigation options
from livestock agri-food systems



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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Thank you

