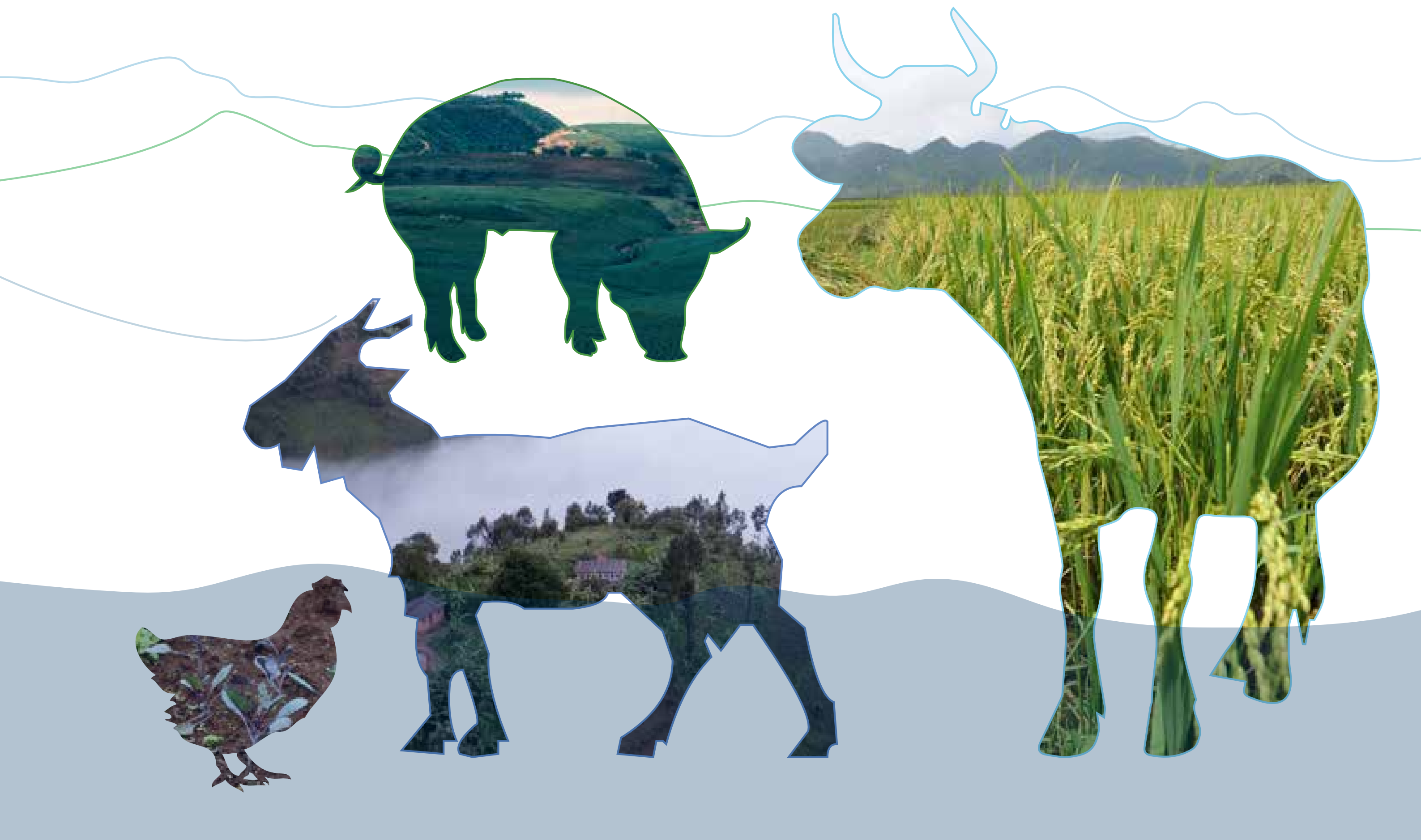
Food and Agriculture Organization of the United Nations

Livestock solutions for climate change



Livestock solutions for climate change

Livestock are key to food security. Meat, milk and eggs provide 34% of the protein consumed globally as well as essential micronutrients such as vitamin B12, A, iron, zinc, calcium and riboflavin. But their contribution to food security and nutrition goes well beyond that, and includes a range of other goods and services, such as animal manure and traction. **Hundreds of millions of vulnerable people rely on livestock in a changing climate**, because of animals' ability to adapt to marginal conditions and withstand climate shocks.

Livestock products are responsible for more greenhouse gases emissions than most other food sources. Emissions are caused by feed production, enteric fermentation, animal waste and land-use change.

Livestock supply chains account for 7.1 GT CO_2, equivalent to 14.5% of global anthropogenic greenhouse gas emissions. Cattle (beef, milk) are responsible for about two-thirds of that total, largely due to methane emissions resulting from rumen fermentation.

Enteric methane emissions represent 30% of global methane emissions. Because **methane is a short-lived climate pollutant,** reducing emissions of enteric methane can help mitigate climate change, within our life times.

Low carbon livestock production is possible. But action must be much more decisive, as the livestock sector is growing rapidly. Fueled by human population growth, higher incomes and urbanization, demand for meat, milk and eggs in low- and middle-income countries is rising.

There is considerable scope for reducing emissions and creating off-sets. The political will to do so has been expressed. Ninety-two developing countries have included livestock in their Nationally Determined Contributions (NDCs) under the Paris Climate Agreement. To move forward, we need effective policies, strong institutions and the application of advanced practices.

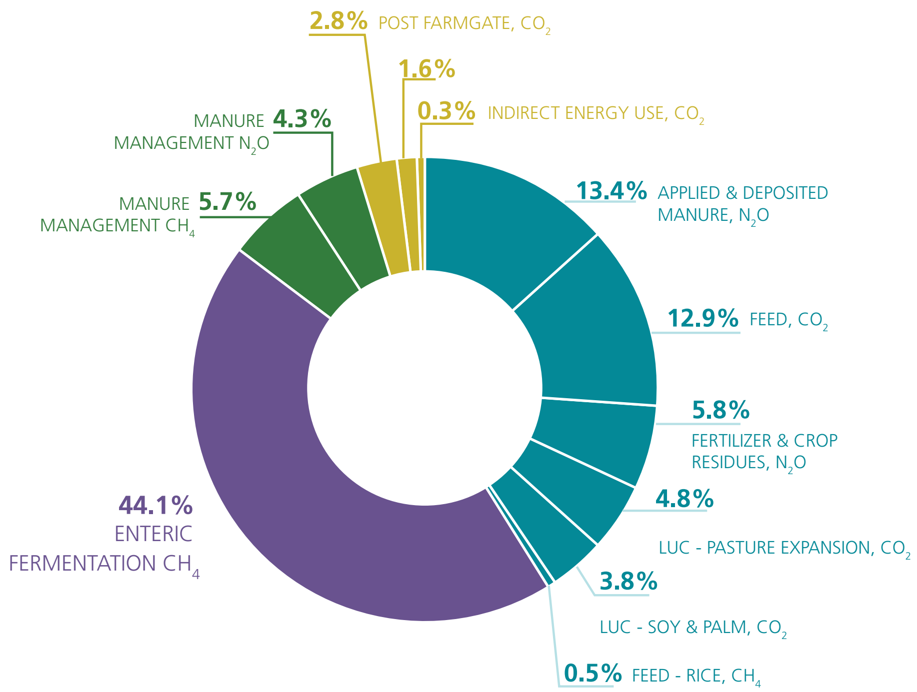
FAO proposes the following three ways to substantially reduce **emissions from livestock production:**

- productivity improvements that reduce emission intensities;
- carbon sequestration through improved pasture management
- better livestock integration in the circular bioeconomy.

These solutions can be combined and they also contribute to **increase resilience to climate change.**

Emissions could also be reduced by targeting the **demand for meat** and other livestock products where consumption is too high.

Global livestock GHG emissions by source



Source: GLEAM 2.0, reference year 2010, http://www.fao.org/gleam/results/en/

SOLUTION 1

Productivity improvements to reduce emission intensities

Emission intensities are emissions expressed per kg of milk, meat or egg. They vary a lot among producers in the same area, indicating considerable scope for improvement. FAO estimates that available **improved husbandry practices can reduce emissions by 20 to 30%,** across all production systems.

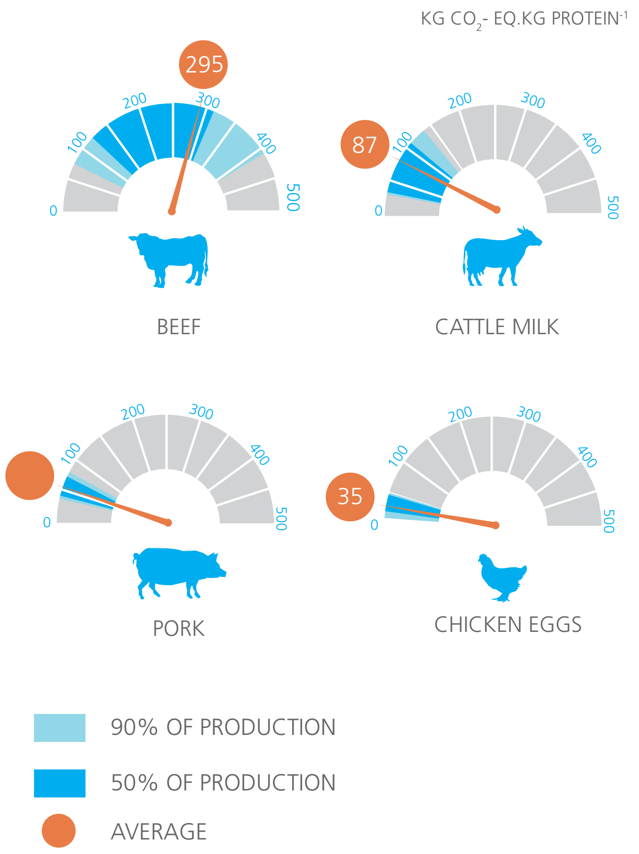
Helping farmers to increase the productivity of livestock is a mean to improve rural livelihoods and food security. It also supports **better resilience to climate change.**

Feed and Nutrition: Improving feed quality can be achieved through improved grassland management, improved pasture species (e.g. grass and legumes mix), forage mix, feed processing (e.g. chopping, urea treatment) and strategic use of supplements, preferably locally available.

Animal Health and Husbandry: Improving reproductive efficiency and extending the reproductive life of the animal will improve lifetime performance per animal and reduce GHG emission intensities. Reducing the incidence and impact of diseases, parasites and insect burdens will result in higher productivity and efficiency "with lower losses and less unproductive animals that emit GHG.

Animal Genetic Resources and Breeding: Breeding is key to increasing productivity by improving traits such as live-weight gain and milk yield or fertility. It can also improve adaption of livestock to changing environments, resistance to stress or shocks and diseases Well planned breeding programmes and conservation of animal genetic diversity can ensure farmers have access to the best animals in each environment.

Global livestock GHG emissions by source



Source: GLEAM 2.0, reference year 2010, http://www.fao.org/gleam/results/en/

Example. Reducing enteric methane for improving food security and livelihoods in 13 countries

GHG	KENYA	MILK
-9.6	SUPPLEMENTATION WITH CONCENTRATE	8.9
-12.5	ESTABLISHMENT OF FODDER GRASSES AND LEGUMES	16.0
-9.8	FEED CONSERVATION (SILAGE)	9.0
-11.3	DEWORMING	14.5
-17.1	CONTROL OF EAST COAST FEVER	25.0
-13.9	ARTIFICIAL INSEMINATION	13.3

FAO is working with scientists, policy makers, industry and farmer organizations to identify and utilize existing low-cost technologies to improve the productivity in ruminant systems in Kenya and 12 other countries. These interventions will improve farmers' livelihoods, lead to more nutritious and affordable food and generate employment and benefits to both rural and urban communities while also offering climate benefits.

http://www.fao.org/in-action/enteric-methane

SOLUTION 2

Carbon sequestration

Permanent pastures and meadows cover about 3.3 billion ha, one quarter of the Earth's land area and 68% of the global agricultural area.

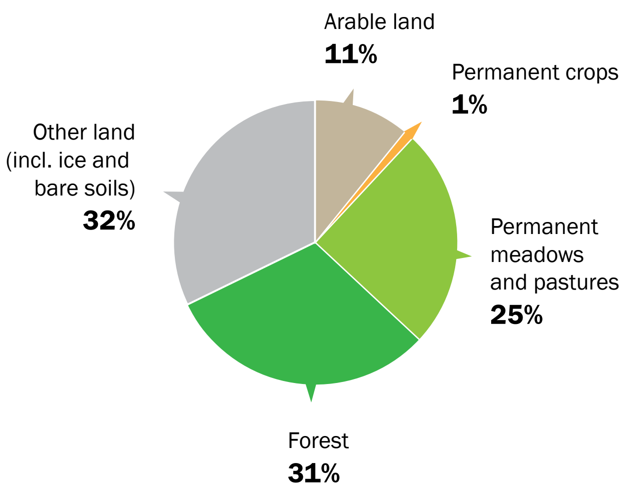
Since the origin of agriculture, 10 000 years ago, people have domesticated and kept livestock for their capacity to turn marginal resources into high value food, produce manure for fertilization, generate fibre and leather, and provide essential services, such as animal traction.

Grazing has a number of ecological functions and roles, including biomass removal that fosters regrowth by preventing accumulation of dead material, prevention of wild fires, regulation of hydrology and water quality by producing diverse landscapes, conservation of rich grasslands biodiversity and pollinators, dispersal of seeds through ingestion and release in dung, but also of organic matter and nutrients. Grasslands are estimated to contain globally 343 billion tonnes of carbon, nearly 50% more than is stored in forests worldwide.

Livestock sector growth, poor grazing management and policy neglect have led to overgrazing and a number of environmental and socio-economic losses. About 20% of grasslands around the world are degraded, which also reduces the capacity of farmers to adapt to climate change. Simultaneously, undergrazing can also result in biodiversity losses, decline in productivity, shrub encroachment and fires.

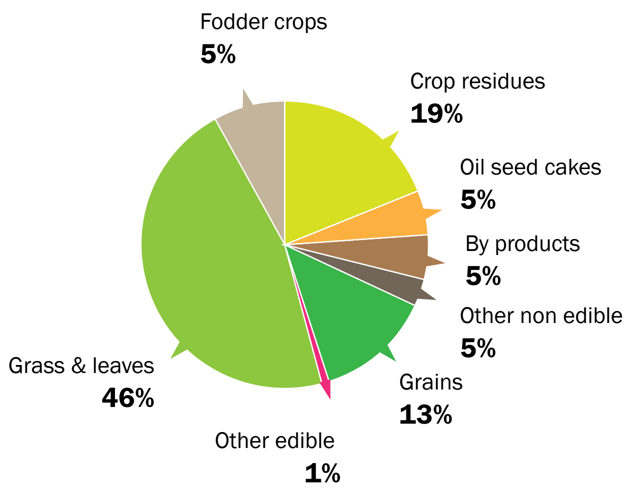
Solutions to restore the quality of pastures and increase soil carbon exist. They include adjusting grazing pressure by balancing spatial and temporal presence of livestock (e.g. with new technologies like solar powered electrical fences), fertilization and nutrient management, introduction of species (e.g. legumes) and plant inoculation, improved mobility of animals in pastoral and agropastoral systems, and the integration of trees and pastures (silvopastoralism)

Global land cover



Source: FAOSTAT

Global livestock feed rations



Source: Mottet *et al.* (2017). In: *Global Food Security*

Example. **The LEAP Technical Advisory Group (TAG) on soil carbon stock changes**

The lack of consensus on a reference method and data to account for soil carbon stock changes is an important barrier to correctly report the sequestration potential and the environmental footprint of livestock products, but also to monitor progress towards national targets.

High spatial variability of soil carbon, the array of management practices in the environmental accountancy and the history of management practices and land use (e.g. from grassland to cropland) are technical challenges. The FAO-hosted Livestock Environmental Assessment and Performance (LEAP) Partnership has set up a Technical Advisory Group on soil carbon stock changes, composed of scientists and representatives of the public and private sectors as well as the civil society, to build consensus on accounting methods as well as guidelines for the sector.

http://www.fao.org/partnerships/leap/en/

SOLUTION 3

Better livestock integration in the circular bioeconomy

While a linear economy uses external inputs to produce outputs and waste, a circular economy minimizes the leaks of energy and materials from the system by re-circulating them in production.

People harvest about 25% of the total biomass produced on Earth every year. The annual feed intake of livestock, about 6 billion tonnes of dry matter, or **20% of this global human appropriation of biomass.** Crop residues and agro-industrial by-products such as bran, molasses or oilseed cakes, represent nearly 30% of the total livestock feed intake. They will be produced in larger amounts as the human population grows and consumes ever more processed food, and could become an environmental burden. Livestock play a critical role in adding value to these products.

Livestock also contribute to the bio-economy and overall food output by **increasing crop productivity through manure and animal traction.** Total nutrients from livestock manure exceeds nutrients from synthetic fertilizers. However, globally livestock manure supplies up to 12% of gross nitrogen input for cropping and up to 23% in mixed crop–livestock systems in developing countries.

Better integrating livestock into the circular bio-economy can be achieved by increasing the share of by-products or waste that humans cannot eat in the livestock feed ration or by recycling and recovering nutrients and energy from animal waste (e.g. biogas). **Improved natural resource use efficiency also helps farmers being more resilient to climate change.**

The circularity needs to be considered at all scales: for example, in mixed crop-livestock systems or silvopastoral systems at farm level; in specialized crop and livestock farms linked via manure banks and feed supply chains at regional/landscape level; in trade of by-products at value chain level, such as whey from cheese factories used in piggeries; in feed exports at international level.

Regulatory frameworks are needed in order to improve integration, in particular related to public health. They need to consider the sanitary and technical requirements for including, for example, insects or waste from households or the food service industry into livestock feed rations. Other limiting factors include disregard of externalities (no carbon tax), and existing subsidies on inputs (e.g. fossil fuel or fertilizers), adaptation of technical solutions to location-specific constraints and lack of access to knowledge and technologies. For example, in Japan, 52% of waste from the food industry is now used as livestock feed, thanks to adequate policies and a certification system.

Example. Improving crop-livestock integration in Zambia

In Zambia, 78% of farms have livestock and 44% have ruminants. While traditional production systems associate crops and livestock, investments as well as public subsidies have focused on maize development, concentrating livestock on marginal pastures leading to degradation and competition for the use of crop-residues between livestock feed and returning organic matter to the soil. FAO is working with partners to assess climate smart solutions for improved productivity and reduced vulnerability of crop-livestock systems, including on-farm trials with the University of Zambia.

FAO's actions to support countries in making low carbon and resilient livestock happen

Strengthening the **knowledge and evidence base** by developing baselines, assessments and projections of emissions. This knowledge also provides a guiding framework for the organization's dialogue with governments, civil society, scientists and the private sector to help achieve objectives on climate policy. FAO's data and assessments at global and national levels contributes to measuring progress made by the sector.

Developing **tools, methodologies and protocols** to measure emissions, developing and assessing technical and policy options, such as the Global Livestock Environmental Assessment Model (GLEAM) and the methodological guidelines developed by the Livestock Environmental Assessment and Performance (LEAP) Partnership.

Piloting and validating technical and policy options through pilot projects and support to up-scaling and investments. For example, FAO in collaboration with the Global Research Alliance on Agricultural Greenhouse Gases (GRA) and the Climate and Clean Air Coalition (CCAC) is focusing on reducing enteric methane emissions for improved livelihoods in 13 countries. FAO is leading Global Environmental Facility projects on climate smart livestock in Ecuador and in Uruguay and has provided analysis and policy support to recent World Bank investments in West Africa, Bangladesh and Ethiopia.

Facilitating multi-stakeholder partnerships and better integration of broad sustainability objectives, creation of synergies and mitigation of trade-offs, for example with The Global Agenda for Sustainable Livestock.

Unlocking the potential for low carbon livestock requires **concerted action** by all stakeholders to invest in the sector, support and undertake the required research, address the institutional weaknesses, provide incentives for efficient and regenerative management, and accelerate the uptake of advanced practices. Solutions exist but must be tailored to local conditions and take **into account the vast diversity of livestock systems and the people who are affected.**

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