Science-fiction or science-fact?
Research for sustainable livestock agri-food systems

TropAg 2022 Keynote presentation
02 November 2022

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I acknowledge the Traditional Owners and their custodianship of the lands on which we meet today and pay my respect to their Ancestors and their descendants.
Key messages

Multiple and contrasting metrics are used for some key livestock-related development parameters—nutrition, climate change, environment.

Demand for food, especially livestock-derived food, is likely to sky-rocket, but that food will have to be produced using the same resource base while mitigating potential harms.

Metrics about livestock can be confusing.

Science must help clarify the evidence and facts to inform decision-making.

Science solutions are needed to address challenges and transform livestock agri-food systems.
Where one stands on livestock issues is a function of where one sits

Let’s not allow our different perspectives to detract from the immense task at hand that we all agree with—ensuring sustainable healthy diets—for everyone
Demand for food will keep growing

Especially in LMICs

- Demand for milk, meat, eggs is increasing fastest in LMICs driven by population, rising incomes and urbanization
- Not based on significant over-consumption in LMICs (attention: ‘double burden’)
- 70% of livestock-derived foods consumed in LMICs are
  - Produced on small-scale farms
  - Sourced in informal markets

**Percentage changes in demand 2010 to 2030**

Projections based on IMPACT model, Dolapo Enahoro (ILRI)
Livestock & Nutrition
NUTRITION: Contrasting livestock metrics can cause CONFUSION

Because of their high nutritional value, livestock-derived foods are essential to the diets of infants and young children, especially in low-resource settings. For other groups, such as those that eat high amounts of livestock-derived foods, consumption should be reduced to improve health and lessen environmental impacts.

Reference diet which includes a reduction in red meat consumption could contribute to saving 11M deaths a year.

Ongoing debate: 2019 Global Burden of Disease estimates for deaths attributed to red meat in 2019 were 36 times higher than in 2017. Metrics and evidence are being questioned.
NUTRITION: Science evidence helps inform decision-making

Science can inform national nutrition guidelines on the roles animal-source foods can and should play in providing healthy, balanced and nutritious diets.
More—not less—animal-source foods are needed in more than half of the world’s regions today to achieve a ‘least cost healthy diet’.

Current consumption levels of “high-priority” foods are on average less than 80 percent of the recommended level to adhere to a least cost healthy diet.
NUTRITION: Livestock research solutions address GLOBAL CHALLENGES

• Provide technical and policy solutions to improve access, availability and affordability of animal-source foods for those who need them most

• ‘De-risk’ the traditional (informal) food markets of lower income countries to ensure that meat, milk, eggs and other fresh foods are safe from food-borne diseases
NUTRITION: Livestock research addresses child stunting

Vaccinating rural poultry flocks against Newcastle disease and supporting animal health technicians to deliver the vaccines:

- enhances poultry productivity
- enhances household well-being
- significantly reduces stunting of both girls and boys

Otiang, E. et al., 2022: https://doi.org/10.1073/pnas.2122389119
Livestock & Climate
Different boundaries used for live cycle assessments result in different results for greenhouse gas emissions.

There are different ways to measure methane emissions (e.g. GWP100 or GWP* for measuring the global warming potential).

Different reports focus on different functional units (e.g. the amount of food or protein or nutrients produced in relation to greenhouse gas emissions).

Considerable variation in reports of livestock impacts on carbon sequestration.

CLIMATE: Contrasting livestock metrics can cause CONFUSION
Results differ when assessing ‘direct’ vs ‘life cycle’ GHG emissions.
Using GWP100 or GWP* to measure methane gives very different results

Australian sheep meat, 2018: kg CO₂ eq per kg protein

Measuring greenhouse gas emissions according to functional unit

Greenhouse gas emissions per 100g edible product

Greenhouse gas emissions to meet recommended daily amount of essential amino acids

Multiple factors impact on carbon sequestration in grazing lands

CLIMATE: Science evidence helps inform decision-making

Global efforts, e.g.:
- Global Research Alliance on Agricultural Greenhouse Gases (GRA)
- Livestock Environmental Assessment and Performance (LEAP)

Regional and local initiatives, e.g.:
Research by ILRI’s Mazingira Centre conducts the first reliable assessments of African and Kenyan livestock-generated greenhouse gas emissions

Emission Factors based on experiments conducted at Mazingira informed the IPCC database

https://cgspace.cgiar.org/handle/10568/122005?show=full
GHGs from different livestock systems need different solutions

Dairy system characterization and emissions

Source: Based on FAO (2013), updated and modified using unpublished 2015 data from GLFAM/3 (2022); credit to FAO (Tim Robinson) and the Global Research Alliance (Hadley Montgomery)
CLIMATE: Livestock research solutions address GLOBAL CHALLENGES

• Improve livestock production efficiencies via
  ➢ Health
  ➢ Genetics
  ➢ Feeds
• Identify genetic opportunities to breed low-methane livestock
• Identify genetic opportunities to breed heat-tolerant livestock
• Explore feed additives that reduce livestock methane emissions
• Manage manure for lower GHG emissions
• Determine the impacts of livestock diseases on GHG emissions
CLIMATE: Livestock research addresses the genetics of heat tolerance

- Milk yields decline when cows are under heat stress, and heat stress is rising under climate change
- Evidence of genetic variations among bulls makes possible improved breeding programs that select ‘climate-tolerant’ animals that maintain good milk yields under heat stress while reducing their greenhouse gas intensity

CLIMATE: Livestock research addresses carbon sequestration in rangelands

Billion tons CO₂ eq per year

- forests
- legume introduction
- grazing management
- biodiversity restoration

max
min


Livestock & Environment
WATER: Contrasting livestock metrics can cause CONFUSION

This global average is mixing:

- Green water (rainfall) with blue water (surface water)
- Intensive production (feedlots) with extensive production (pastoralist) livestock systems
- Whole lifecycles with component parts

Does it really take 15,000 litres of water to produce 1 kilogram of beef?
WATER: science evidence helps inform decision-making

Where does the water required to produce beef come from?

Calculated by combining grazed, mixed, and industrial farming in China, India, the Netherlands, and the USA

4% blue water (groundwater, surface water)

96% green water (mostly rainwater)

WATER: Livestock research addresses GLOBAL CHALLENGES

- Improving water-use efficiency in smallholder livestock systems
- Recycling water
- Improving rangeland vegetation management
LAND: Contrasting livestock metrics can cause CONFUSION

Livestock use over half the world’s land

Total terrestrial surface 148 million sq km

21% livestock only
24% livestock supports crop production

Source: Rangelands Atlas, 2021
LAND: Livestock research addresses GLOBAL CHALLENGES

6 billion tonnes dry feed

Could be eaten by humans 14%

Inedible by humans 86%

5 billion ha global agricultural area

Crop agriculture 49%

Feed production 10%

Grassland that could be converted for crops 14%

Pastures/rangelands - not suitable for crops 27%

LAND: Livestock research addresses rangeland management

Participatory rangeland management and participatory grazing planning with local communities is helping to rehabilitate rangeland ecosystems, to secure land tenure and to increase the resilience of pastoralist communities.

LAND: Livestock research addresses feed challenges

The straw and stover by-products of crop production make up more than half of livestock feed resources in lower income countries.

Research on cereal, legume and tuber crops shows that genetic variation in their livestock feed traits can be exploited to increase livestock productivity by 15–25% with little to no trade-offs in grain yields.

Superior ‘dual-purpose’ (feed as well as food) crops are now being bred to make their residues more nourishing for cattle, goats and sheep.

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Let’s not allow our different perspectives to detract from the immense task at hand that we all agree with... sustainable healthy diets, ....for every citizen....
Thank you!

The International Livestock Research Institute (ILRI) is a non-profit institution helping people in low- and middle-income countries to improve their lives, livelihoods and lands through the animals that remain the backbone of small-scale agriculture and enterprise across the developing world. ILRI belongs to CGIAR, a global research-for-development partnership working for a food-secure future. ILRI’s funders, through the CGIAR Trust Fund, and its many partners make ILRI’s work possible and its mission a reality. Australian animal scientist and Nobel Laureate Peter Doherty serves as ILRI’s patron.

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