

ILRI's research GHG emissions across Africa



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INTERNATIONAL
LIVESTOCK RESEARCH
INSTITUTE



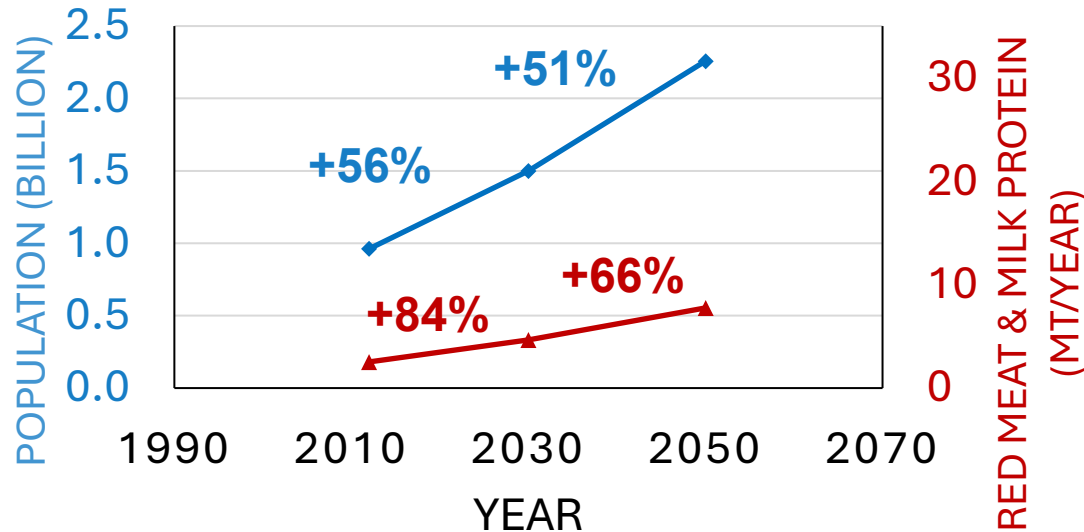
Claudia Arndt, PhD
Senior Scientist
Team-Lead of the Mazingira Centre

Funders & Frontiers:
Pathways to livestock emission reduction.
23 April, virtual.

Rising Demand and Food Security Challenges



AFRICA

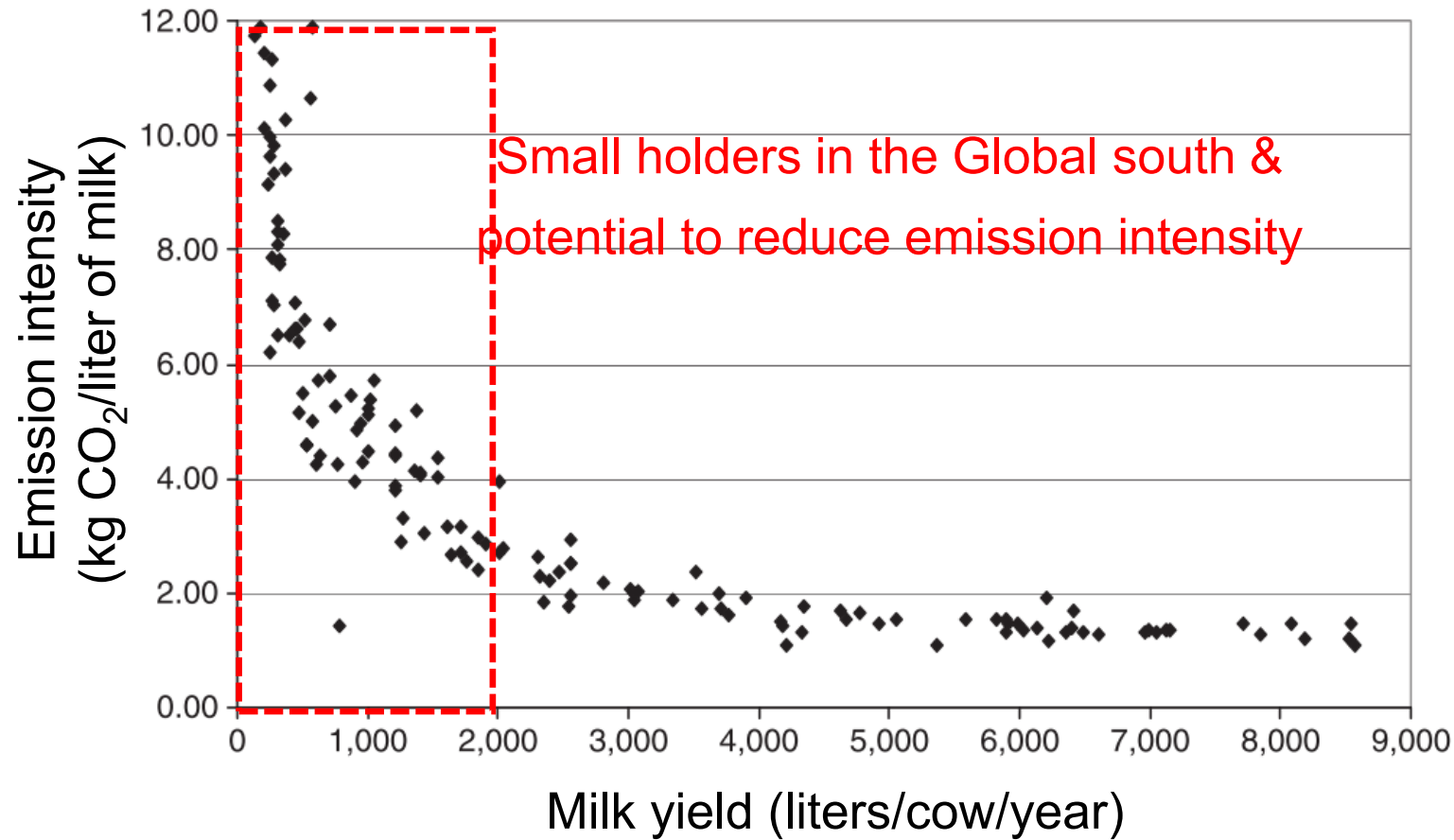


Continent	Red meat & milk protein (g/capita/d)		
	2012	2030	2050
Africa	7.2	8.5	9.4
Europe	28.6	30.3	30.4

- Population growth will increase demand for animal products.
- Per capita consumption of animal protein will remain low compared to Europe.
- Addressing the rising demand for animal protein in Africa is crucial for food security and economic development.



Productivity Reduces Emissions Intensity



- Increasing milk production reduces emissions per product
- The lower the productivity of the system the greater the emission reductions

Improving productivity is the fastest route to reducing emission intensity

Boosting Livestock Productivity, Reducing Emissions



Climate Change

Climate change means long-term shifts in temperatures & weather patterns.



Why It Matters

Climate change brings hotter days, droughts, & intense rains, affecting livestock productivity and crop yields.



Water and Feed Shortages

More frequent droughts lead to less water and quality feed, resulting in higher costs and lower yields.



Increase in Diseases and Pests

Changing weather patterns increase pests & diseases, leading to greater animal health risks & more costs for treatment.

Heat Stress on Animal

Higher temperatures cause livestock to overheat, reducing milk and meat production and increasing the risk of illness.



How Livestock Contributes to Climate Change

Animal Emissions



What is Climate Change?

Manure Emissions



Climate Change Impact



What It Takes to Succeed

Win-Win Solutions



Climate-Smart Practices That Can Be Implemented Today

Manure Management



Recycles nutrients and improves soil fertility. Biogas turns waste into clean energy.



Enhancing Feed Quality

Increases milk production, improves animal health, and strengthens resilience.



Grazing Management

Boosts biodiversity, enhances drought resilience, and maintains soil cover & pasture health.



Health Monitoring

Routine health checks minimize production losses due to disease.

Better Data for Informed Decisions

Collect local data, strengthen Measurement, Reporting, and Verification (MRV), and guide decisions to track progress and improve practices.



Building Local Capacity

Build local capacity through research, farmer training, and supporting policies to scale climate-smart solutions.



Fostering Collaboration

Build local capacity through research-driven solutions, farmer training, and support policies to scale climate-smart practices.



Mazingira Vision & Mission

Vision

To create environmentally sustainable, climate-smart, food- and nutrition-secure livelihoods for smallholder farmers and livestock keepers in the Global South.

Mission

With a state-of-the-art **Environmental Research and Education Centre**, we:

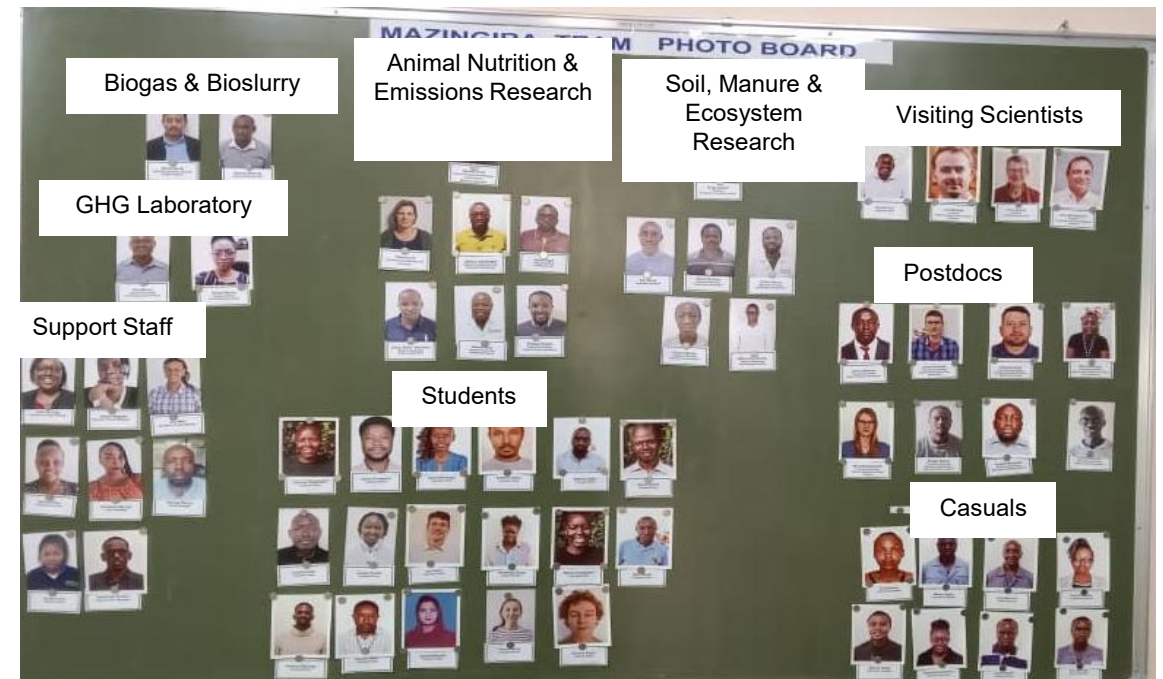
- **Generate environmental baseline data** for livestock production systems.
- **Develop, test, and scale climate mitigation and adaptation strategies** to boost productivity, reduce GHG emissions, minimize environmental impacts, and improve resource use.
- **Serve as a regional hub** for research, sample analysis, capacity building, and scientific exchange to support evidence-based decision-making.

ILRI's Mazingira Team & Capacity

Mazingira works with **few senior scientists** and a strong group of **technicians, students, and postdocs**, supported by **visiting scientists and international collaborators** to build capacity.

- Daniel Mulat leads lab and biogas research
- Claudia Arndt leads animal nutrition and modelling (25% of Vibeke Lind and Habbibou Assouma)
- Sonja Leinter leads manure and ecosystem research.

Sonja will be **transitioning out**, so we are **seeking a replacement**, please get in touch if interested or know someone suitable (claudia.arndt@cgiar.org)



From data to decision support

- Transforming livestock systems -



Better GHG Inventories:

- Tier 2 emission factors and MRV data now integrated into Kenya's national GHG inventory and NDCs.

Tools & Protocols Developed:

- Created Tier 2 data collection methods, field tools, and laboratory protocols to strengthen national measurement capacity.

Mitigation Pathways Identified:

- Quantified CH₄ and N₂O reduction potential from improved feed, manure, and management practices.

Productivity Gains:

- Demonstrated how higher yields can reduce emissions intensity while improving milk and meat output.

Scientific Capacity Built:

- Trained 200+ researchers and technicians in GHG measurement, modelling, and climate-smart livestock practices.

Policy & Investment Guidance:

- Provided evidence shaping carbon markets, climate finance, and national livestock strategies.

Farmer-Level Impact:

- Co-developed solutions with smallholders that strengthen livelihoods, resilience, and climate adaptation.

MAZINGIRA CENTRE: A HUB OF ENVIRONMENTAL RESEARCH IN AFRICA



ON-FARM MEASUREMENTS

BRIDGING SCIENCE AND PRACTICE

Animal Productivity & Emissions



Feed Management & Production Systems



Circular Manure Management



GHG Inventory & MRV Support



ON-STATION WORK - KAPITI RANCH

FIELD-SCALE INTEGRATED OBSERVATIONS

Carbon Flux Monitoring



Rangeland Productivity & Emissions



Animal Productivity & Emissions



Pasture Restoration & Biodiversity



RESEARCH LAB - ILRI NAIROBI CAMPUS

CORE LABORATORY AND RESEARCH HUB

Analytical Services Laboratory



Animal Productivity & Emissions



Manure, Soil & Pasture Management



Circular Economy - Biogas Digester



Measurements: Mazingira Centre Research

Animal Emissions & Nutrition

- Feeding experiments using respiration chambers
- In-vitro digestibility (DMD) and GHG emission testing of legumes and other feeds
- Enteric methane mitigation trials with feed additives and diet manipulation

Manure Management & Bioenergy

- Biological methane potential measurements of manure
- Biogas production optimization and leakage quantification
- Solar-assisted hydrogen production and methane capture integration
- Composting experiments for emissions and nutrient recycling

Nutrient Cycling & Soil GHG dynamics

- Quantification of N_2O and CH_4 fluxes from manure-amended soils
- Nutrient circulation and soil health experiments under different management practices

Analytical Services & Capacity Building

- Sample analysis and laboratory services for external research partners
- Training and scientific exchange to build regional research capacity



Systems: Kapiti Ranch Research

Ecosystem Monitoring & Climate Interactions

- Eddy covariance tower measurements of carbon, water, and energy fluxes in semi-arid rangelands and dry land agriculture
- Monitoring of pasture composition, productivity, and nutrient quality
- Soil GHG flux measurements under extensive grazing systems and in bomas

Animal Emissions & Productivity

- Enteric methane emission measurements from grazing cattle in natural conditions

Systems & Climate Resilience Research

- Integrated system-level assessments linking emissions, productivity, and environmental outcomes



On-Farm Research

Productivity & Emissions Benchmarking

- On-farm data collection on milk yield, animal growth, and GHG emission intensity
- Development of Tier 2 emission factors for different production systems
- Productivity and GHG intensity assessments across management regimes

Manure, Biogas, & Mitigation Strategies

- Monitoring emissions from manure storage and field application
- Field testing of mitigation interventions to reduce CH₄ and N₂O emissions
- Biogas system assessments – evaluating emission reductions and health co-benefits from shifting household energy use from firewood to methane stoves

Intervention Testing

- On-farm testing of interventions to improve productivity and reduce emission intensity

Ecosystem Restoration & Long-Term Field Studies

- Long-term experiments on soil restoration, pasture recovery, and system resilience under different management strategies



Modelling: From Data to Decision Support

Animal Productivity & Feed Models

- Develop heart-girth equations to estimate body weight.
- Quantify the effects of legumes on productivity and methane emissions.
- Improve dry matter intake (DMI) estimates, addressing systematic underestimation in IPCC methods.

System-Level Emissions & Mitigation

- Model dairy sector emissions and mitigation potential in Kenya, including productivity and meat production targets (published).
- Develop beef sector emission reduction scenarios currently in progress.

Health & Emissions Linkages

- Use GBADs modelling to assess how disease burdens affect productivity and GHG emissions in Ethiopia.

From Measurement to Impact



Measurement → Systems → On-Farm → Modelling → Impact

Generate
environmental
and GHG data



Assess real-world
livestock systems,
from smallholder
dairy to rangelands.



Co-develop and test
practical solutions
with farmers.



Translate
measurements into
scenarios, policies,
& mitigation
strategies.



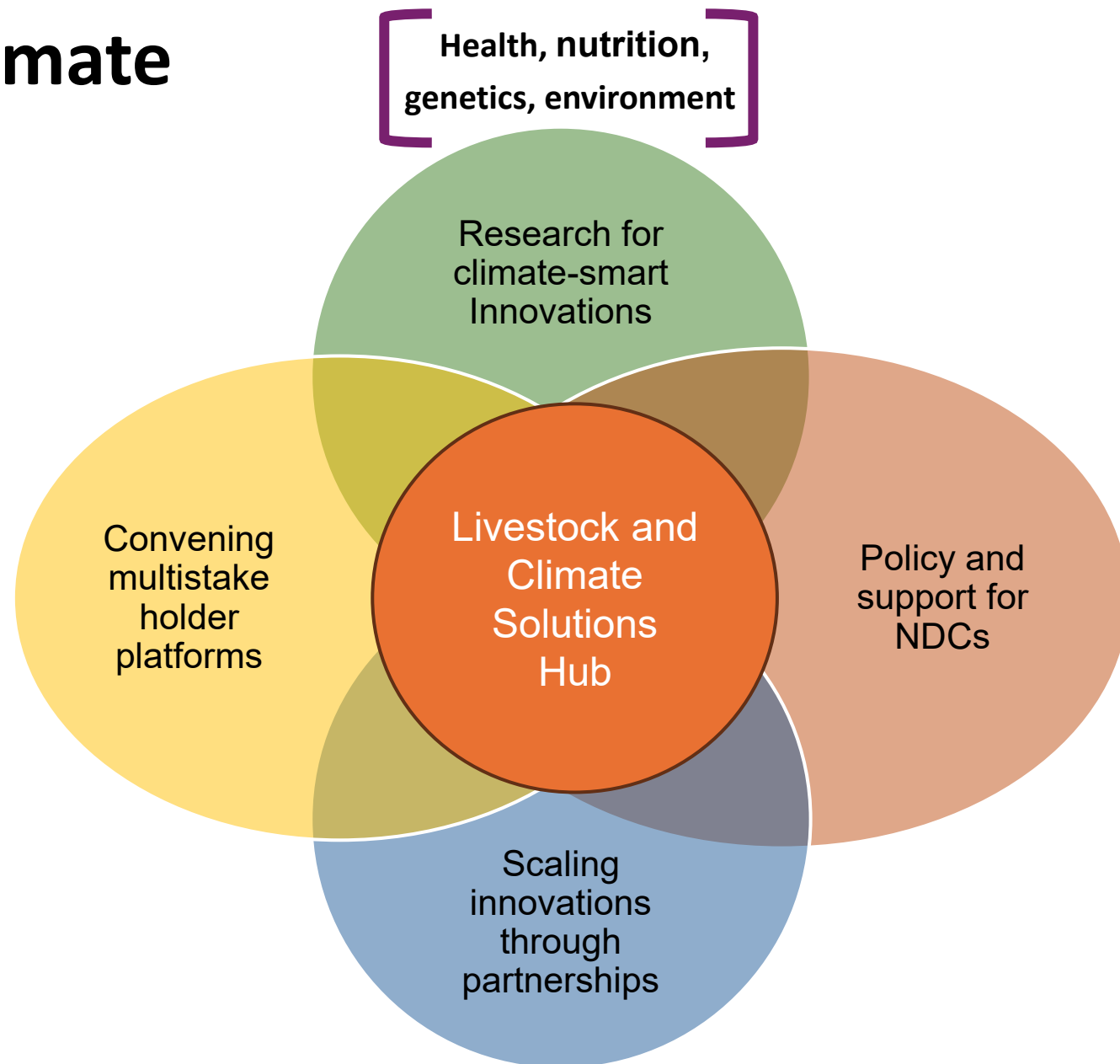
Policy change,
climate action,
improved livelihoods,
and real-world
outcomes.



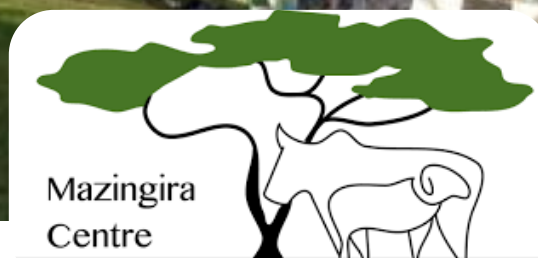
NEW: Livestock and climate solutions hub

THE VISION

Transitioning to climate-smart livestock systems through adaptation and mitigation



Thank you very much for your attention!



<https://mazingira.ilri.org/>



Better lives through livestock

Contact:

Claudia Arndt, PhD

claudia.arndt@cgiar.org



Mitigate+ Research
for Low-Emission
Food Systems



LCSR: Livestock,
Climate and System
Resilience



SAAF: Sustainable
Animal and Aquatic
Foods



CA: Climate
Action



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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. You are free to use and share this material under the Creative Commons Attribution 4.0 International Licence .

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through
livestock*

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