Methane Emissions in Sub-Saharan Africa: Scientific Gaps and Unique Considerations for Livestock Adaptation and Mitigation

Livestock Methane: Identifying gaps to advance meaningful solutions
Online, 13th of July 2023

https://mazingira.ilri.org/

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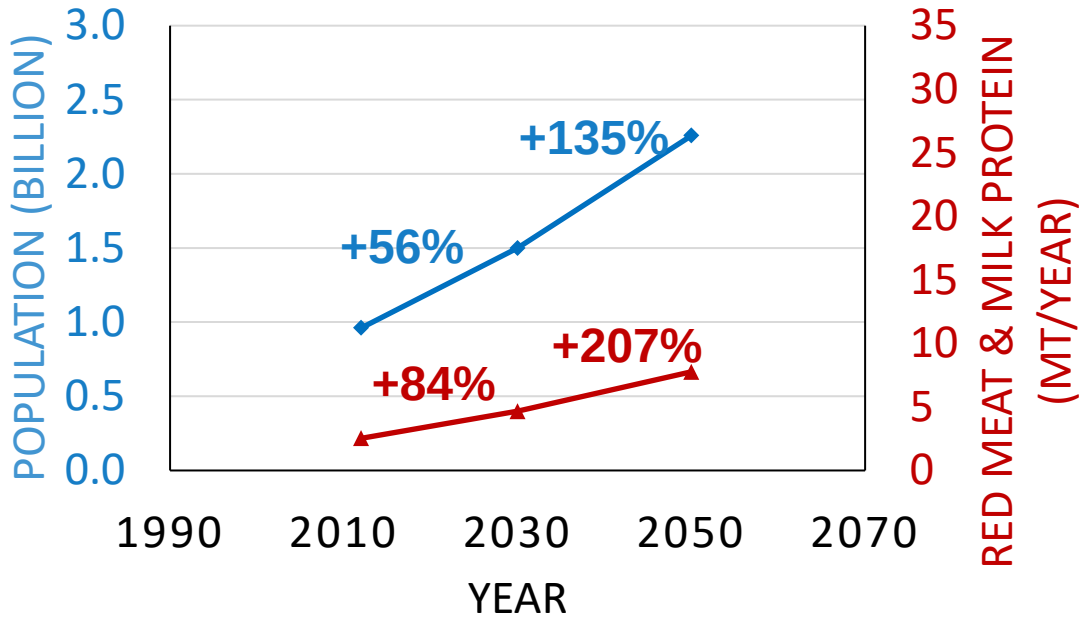
ILRI CGIAR

Mazingira Centre - Vision

- To test and develop management strategies that increase livestock productivity while decreasing GHG emissions, resource use, and environmental degradation

Africa

Projected Growth in Population and Animal Protein Demand in



Red meat & milk protein (g/capita/d)		
2010	2030	2050
7.2	8.5	9.4
	+15%	+10%

MT: Million metric tons

Source: Modified after Henchion et al., 2021 and FAO.

Prevalent Livestock Systems in Africa

Smallholder systems

humid & sub-humid areas

- Own 80% of arable land (<10 ha)
- Small livestock holdings (<10 cattle)
- Mixed cattle herd composition (~45% adult females)
- Milk productivity: ~4 liters/day

Pastoralist/agropastoral systems

semi-arid & arid areas

- Larger, multi-species herds
  - 48% cattle
  - 46% small ruminants
  - 6% camels
- Milk productivity: <2 liters/day

Sources: Lowder et al., 2016; Ndung'u et al., 2022; Rahimi et al., 2022; Coppock et al., 1986

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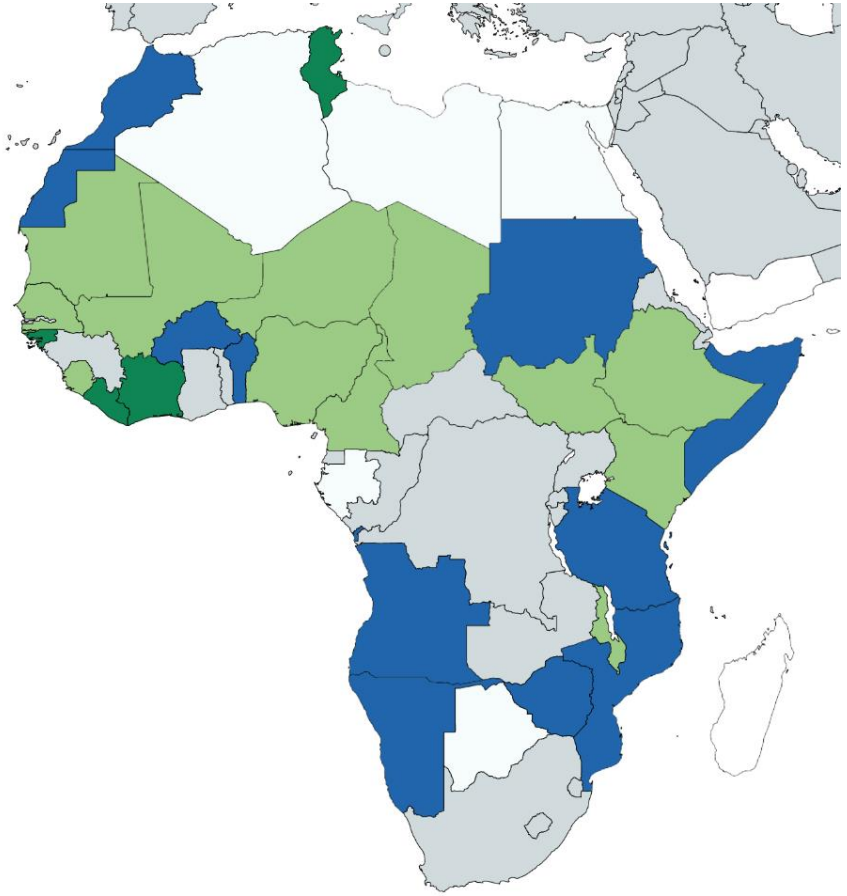
Countries that Include Livestock in New & Updated NDCs



Out of 54 African countries:

- 16 countries include **Mitigation & Adaptation** measures
- 5 countries include livestock **Mitigation** measures

- 14 countries include **Adaptation** measures
- 9 countries include no livestock measures
- 10 countries include no new or updated NDCs

Adaptation addresses the impacts of climate change

Mitigation addresses the causes of climate change

Both approaches are needed in developing countries!

Source: Modified Rose et al., 2021 & https://ccafs.cgiar.org/index.php/resources/tools/agriculture-in-the-ndcs-data-maps-2021

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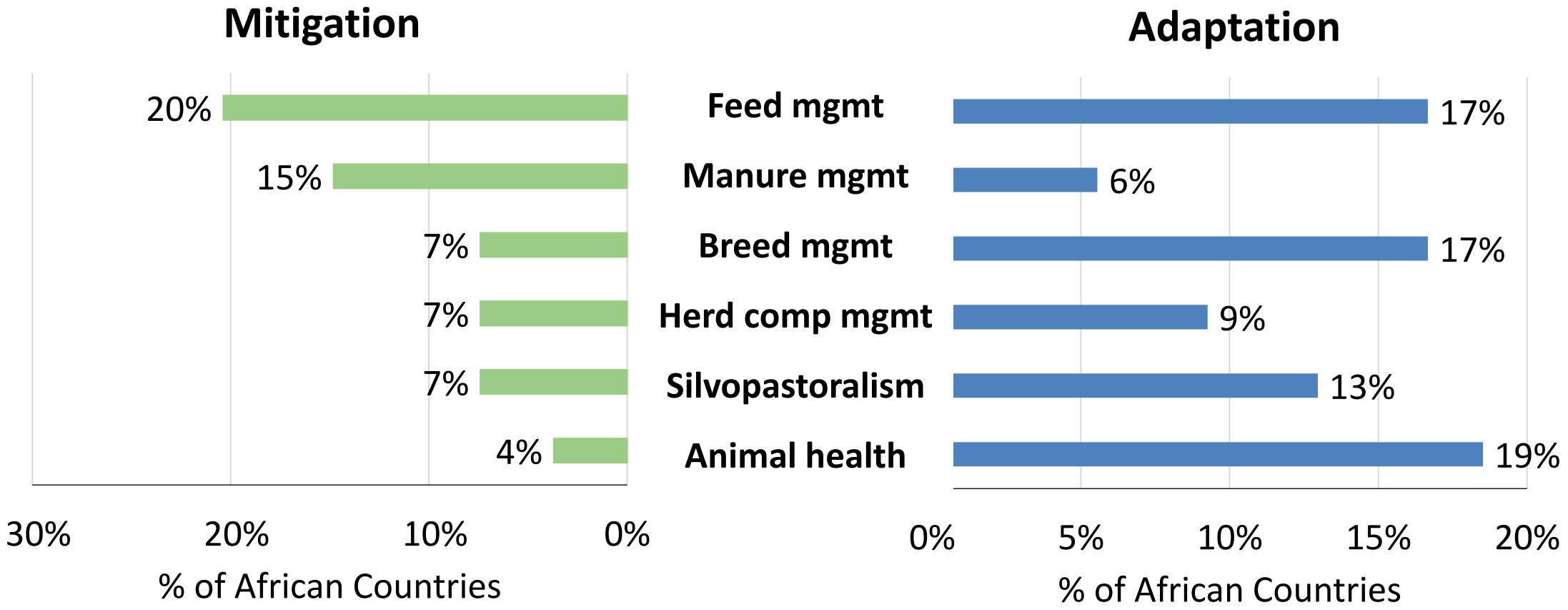
Mitigation & Adaptation Strategies in NDCs of African Countries



Source: Rose et al., 2021 and https://ccafs.cgiar.org/index.php/resources/tools/agriculture-in-the-ndcs-data-maps-2021

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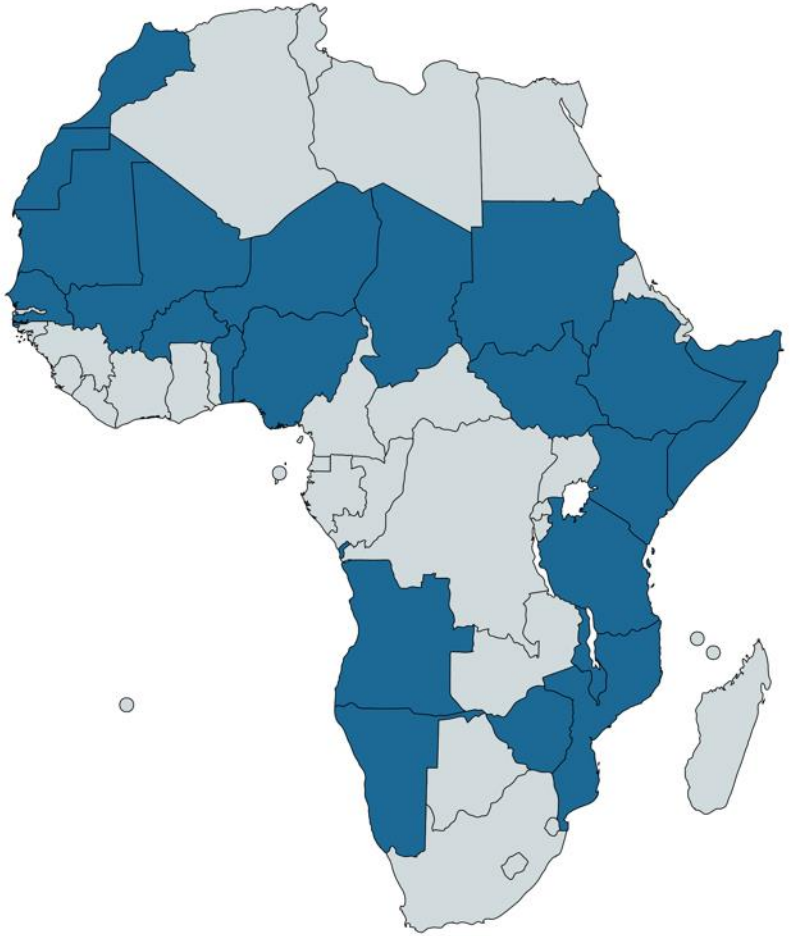
No Capacity to Track Livestock Adaptation

Countries with livestock adaptation in their new or updated NDCs



- Currently no international reporting on Adaptation Tracking
  - First instrument designed and nearly completed

Source: Todd Crane (ILRI); personal communication .

Capacities to Track Changes in GHG Emissions Do Not Match NDC Ambitions

Countries with livestock mitigation in their new or updated NDCs

Source: Rose et al., 2022
https://ccafs.cgiar.org/index.php/resources/tools/agriculture-in-the-ndcs-data-maps-2021

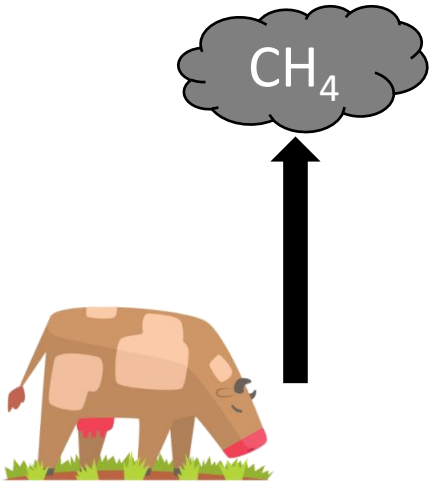
Countries that have or are developing some Tier 2 Inventory for Livestock

Source:
Wilkes; personal communication.

Research Progress on GHG Emissions From Livestock in Sub-Saharan Africa Falls Short of National Inventory Ambitions

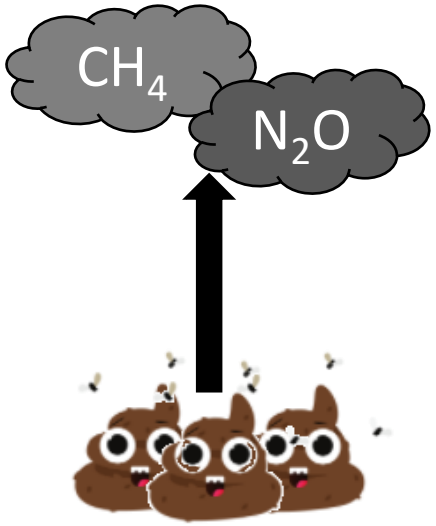
Enteric CH_4 Emissions

- 14 studies for cattle
- 6 studies for small ruminants



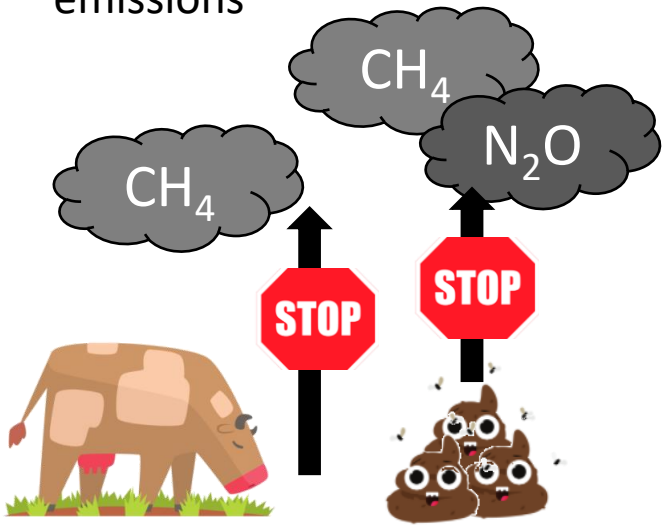
Manure GHG Emissions

- 6 studies for cattle manure
- No studies for small ruminants



Mitigation

- 5 cattle and 2 sheep studies on enteric CH_4 emissions
- No studies on manure GHG emissions



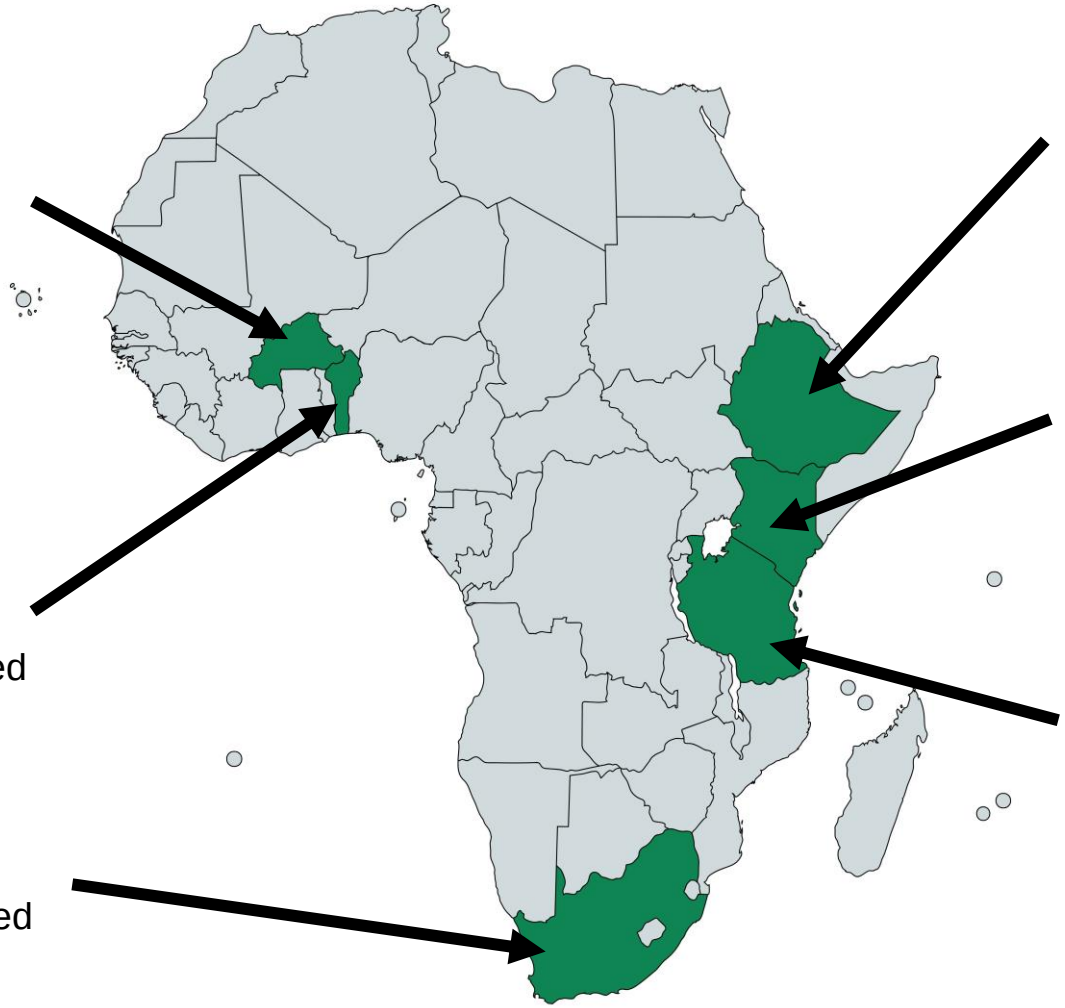
Source: [Graham et al., 2022]

Locations With Equipment to measure Enteric Methane

Burkina Faso
- 1 GreenFeed for small ruminants & 1 for cattle

Benin
- 1 GreenFeed for cattle to be delivered

South Africa
- Cattle & small ruminant chambers
- 3 GreenFeed for cattle to be delivered
- SF6
- Laster methane detector



Ethiopia
- 1 GreenFeed for cattle

Kenya
- Cattle and small ruminant chambers
- SF6 under development

Tanzania
- Methane Laser

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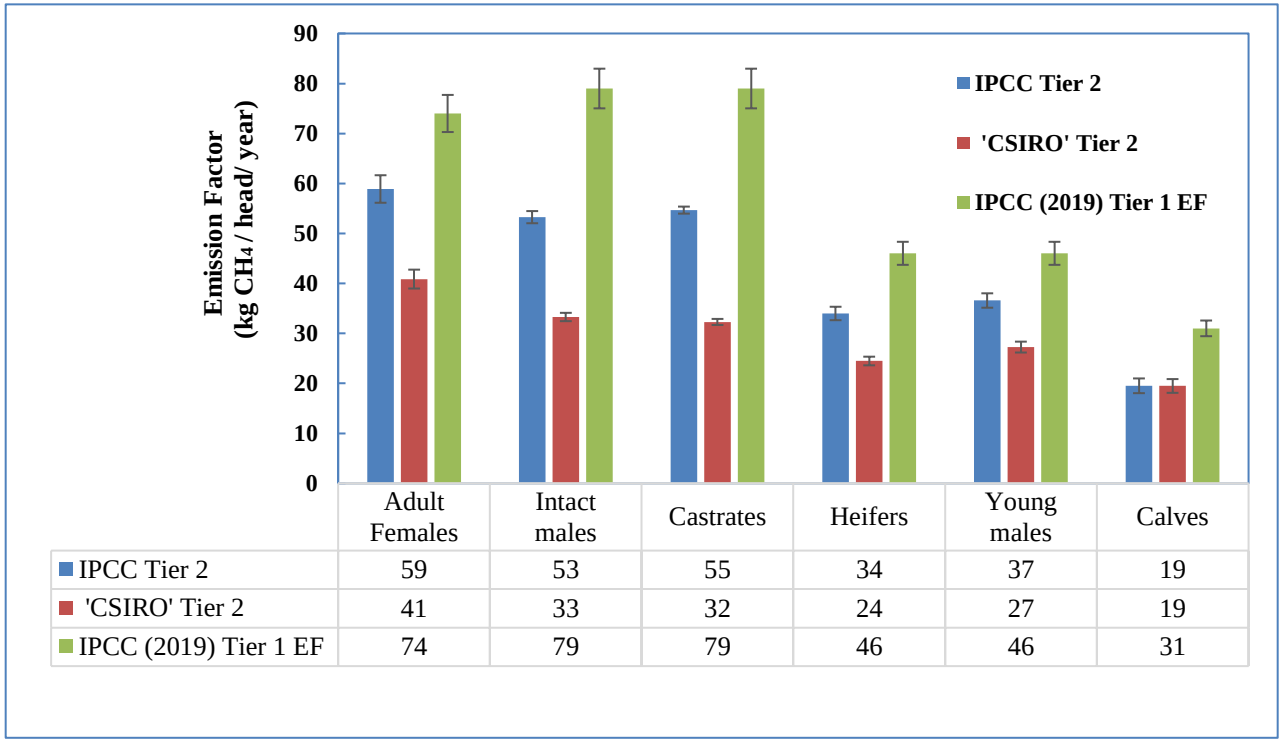
Preliminary Results

Enteric CH_4 Emission Factors are Significantly Different Between 2 Models Based on Global North Data



	Adult Females	Intact males	Castrates	Heifers	Young males	Calves
IPCC Tier 2	59	53	55	34	37	19
'CSIRO' Tier 2	41	33	32	24	27	19
IPCC (2019) Tier 1 EF	74	79	79	46	46	31

Error bars are expressed as ± 95% confidence interval

Source: Balcha et al. manuscript under development

GLOBAL RESEARCH ALLIANCE ON AGRICULTURAL GREENHOUSE GASES

CGIAR LCSR: Livestock, Climate and System Resilience

CGIAR Mitigate+: Research for Low-Emission Food Systems

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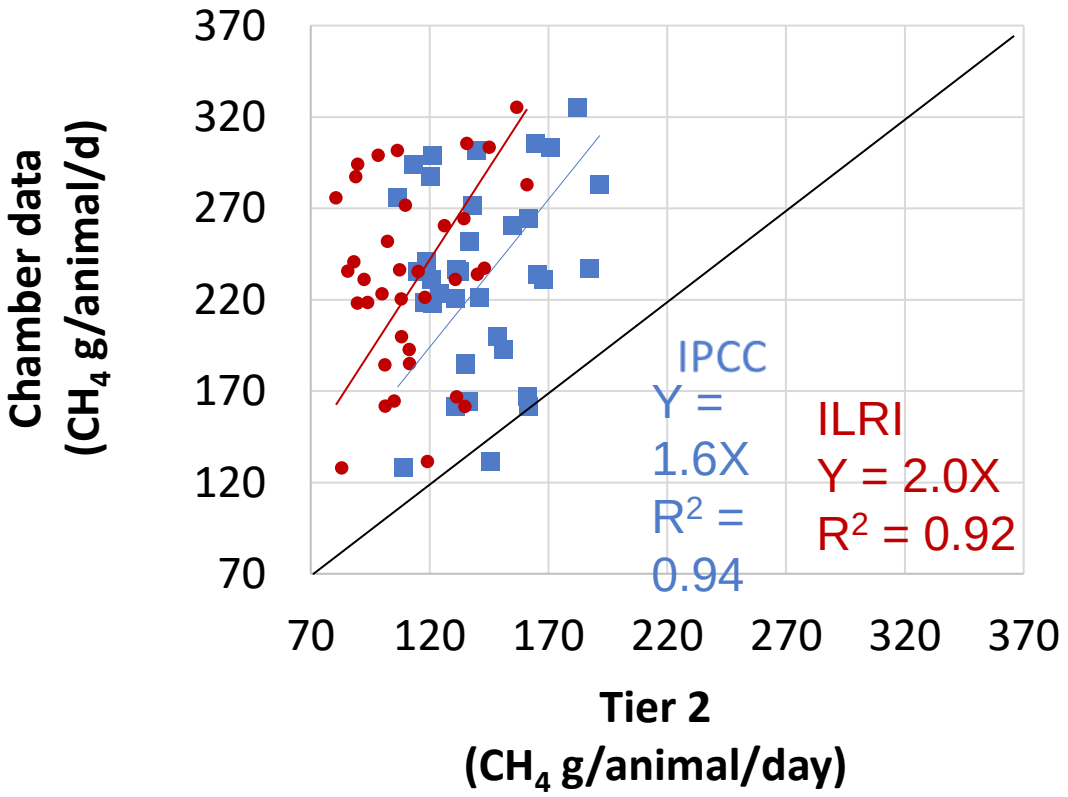
Preliminary Results

Enteric CH_4 Emissions From Chambers Are Greater Than Tier 2 Estimates



- Similar differences were observed for gross energy intake

→ There is a need to develop prediction equations based on local data

Need for funding and capacity building

- Funds for equipment is needed but are not enough!
- When equipment funding is given, long-term funding should be supplied to maintain and use infrastructure
- Funding schemes need to be put in place to increase capacity of researchers and students.
- Capacity building can be accelerated through south-south and south-north collaborations.

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Most important mitigation strategies

Climate Smart Agricultural (CSA) Practices achieve “Triple Wins”:

1. Increased productivity
2. Adaptation and resilience to climate change
3. Reduced greenhouse gas emissions

→ Production increases and mitigation potential of CSA practices needs to be measured to determine what CSA practice should be promoted in what production systems

Funded by the European Union
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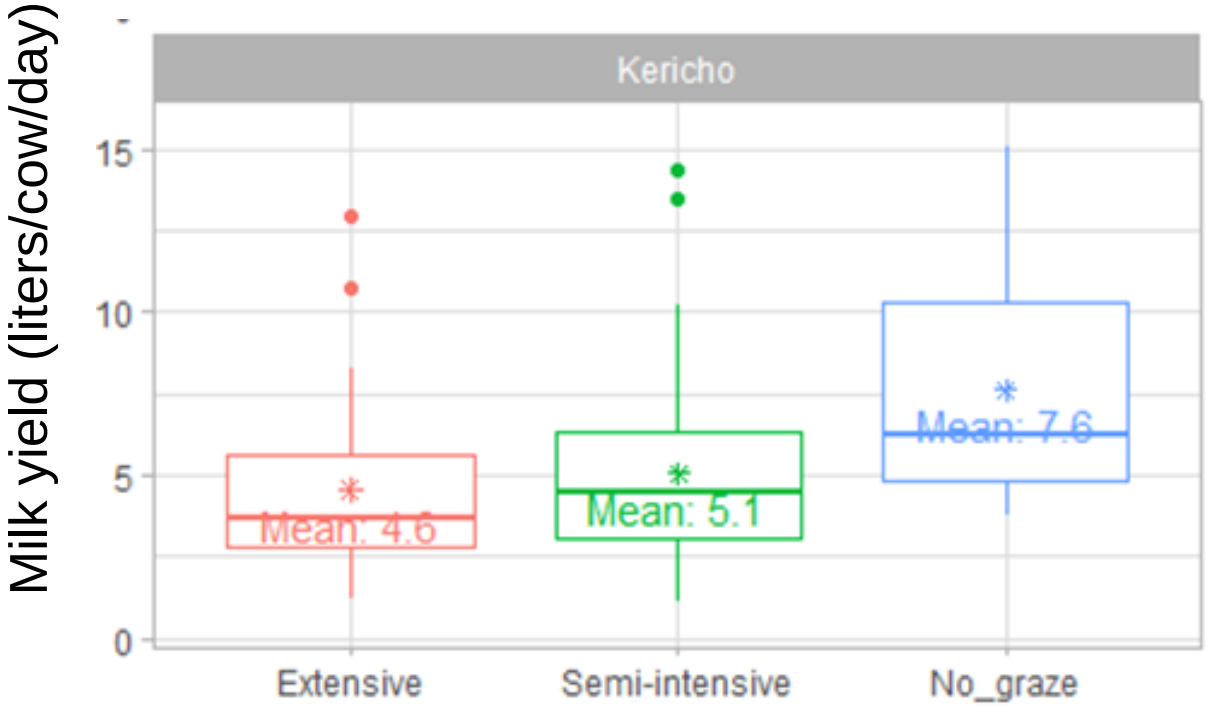
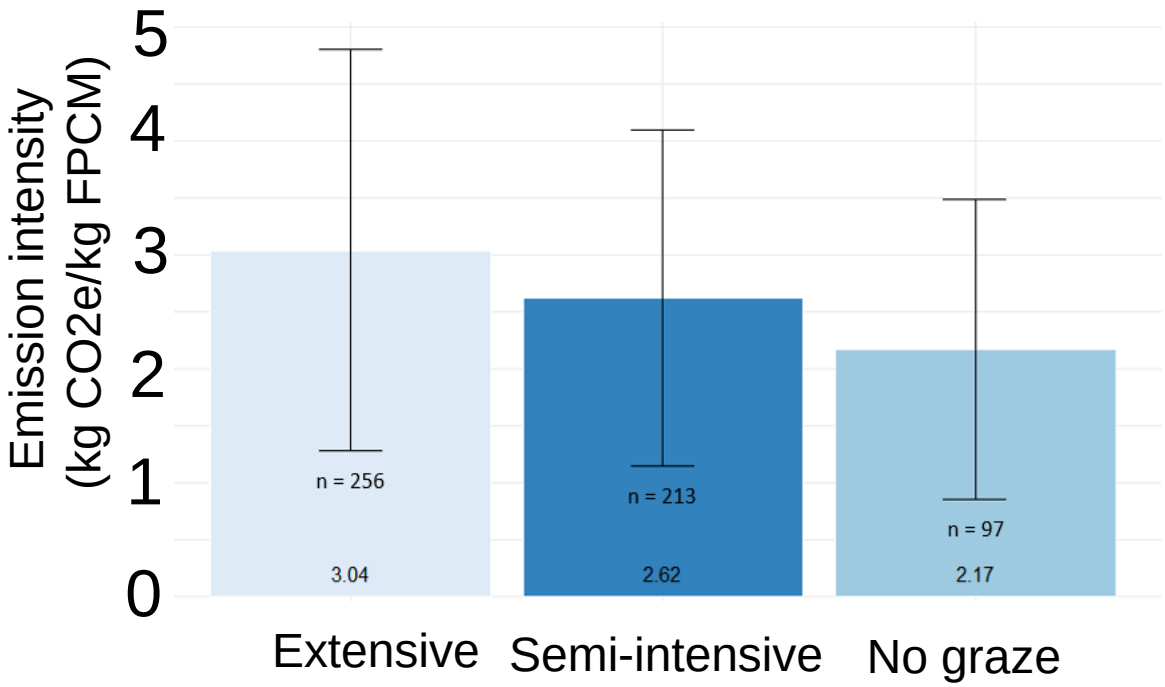
Case study 1: Climate-Smart Practices – Dairy Value Chain

Kenya Climate Smart Agriculture Project (KCSAP)

CSP Category	Individual practice
Reproduction	Artificial insemination (AI) services; Breeding improvements
Feed processing	Chaff cutter; Improved machinery
Fodder improvement	Improved fodder; Fodder establishment; Fodder improvement
Feed preservation	Feeds preservation; Hay; Silage making
Feed supplements	Dairy concentrates; Own farm feed formulations; Feed formulation
Health	East Coast Fever vaccination
Fertilizer	Fertilizer use
Pasture interventions	Improved pasture; Legumes mixed with Kikuyu grass; Pasture management; Pasture establishment and management
Feeding of by-products	Use of maize stovers
Water harvesting	Water harvesting
Stall feeding and housing improvements	Semi-zero grazing unit; Zero grazing unit; Improved housing; Improved dairy unit; Improved housing; Dairy unit improvement
Milk Marketing	Milk marketing

Milk Production and Emission By Dairy Production System



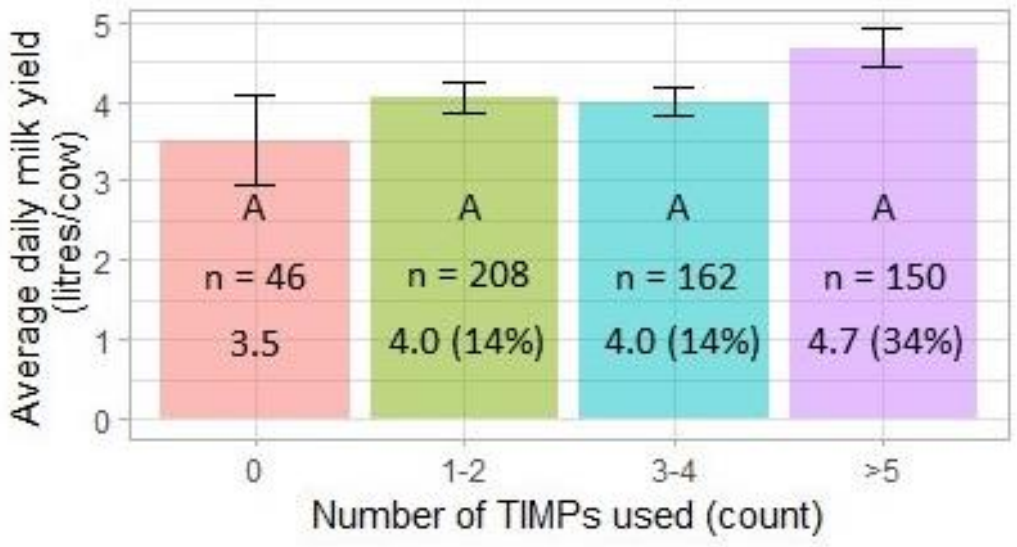


→ Significant gains can be reached by optimizing a production systems

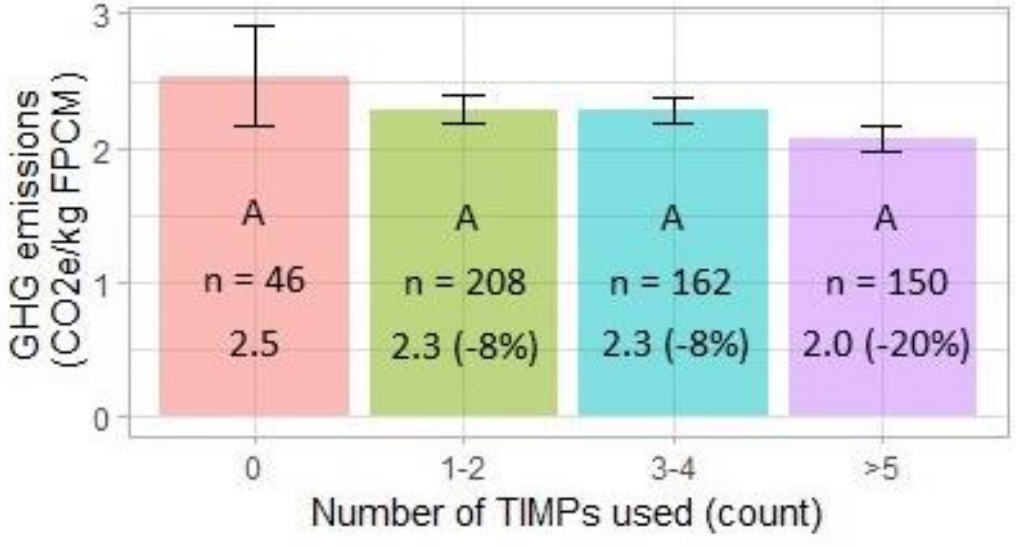
Preliminary Results

Effect Of CSA Practice Adoption On Production And Emission Intensity

Milk yield



Emission intensity



→ The more Climate-Smart Agricultural (CSA) practices are adopted, the higher milk yields and GHG emission abatement

Error bars are expressed as ± 95% confidence interval

Source: Caulfield et al. report and manuscript under development

Republic of Kenya
KCSAP Kenya Climate Smart Agriculture Project (KCSAP)
Prifysgol Bangor University
Newton Fund
CGIAR LCSR: Livestock, Climate and System Resilience
CGIAR Mitigate+: Research for Low-Emission Food Systems
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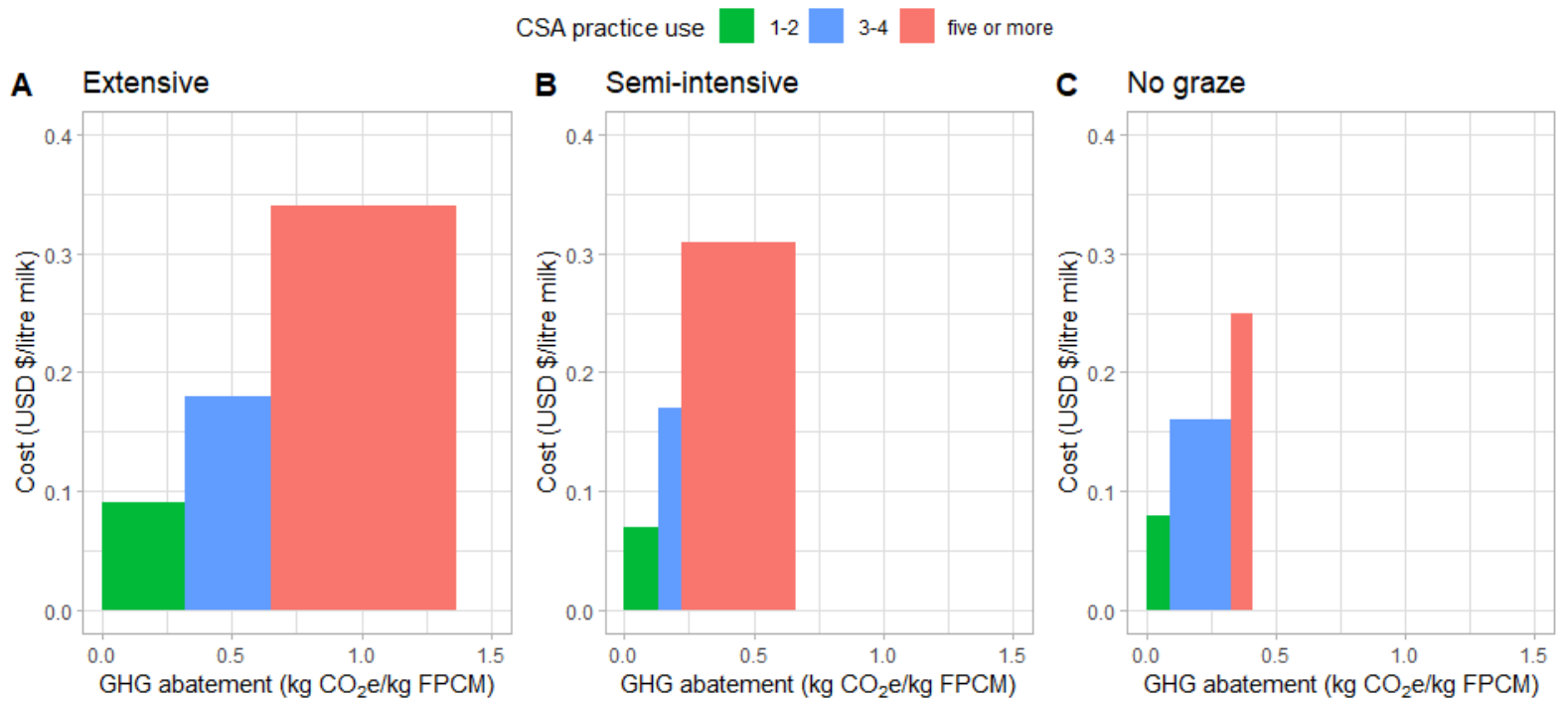
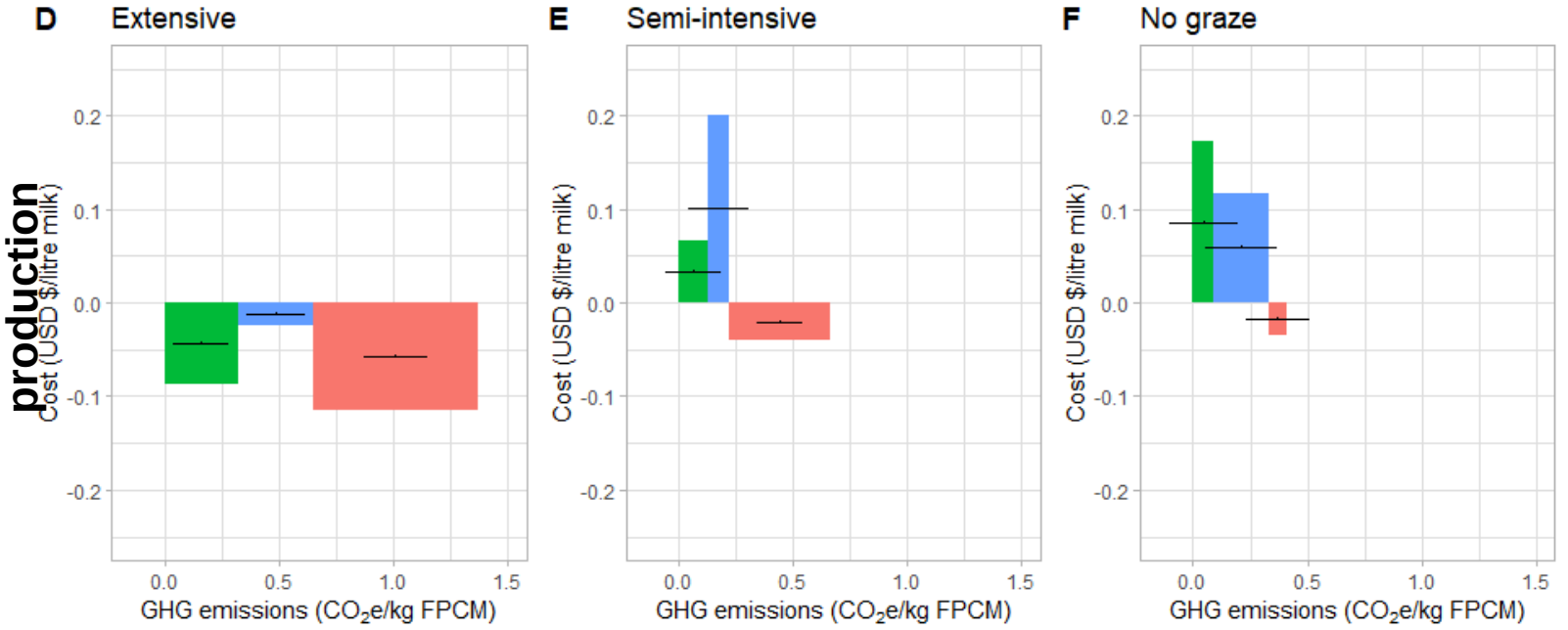
Preliminary Results

Marginal Abatement Cost Curves For The Use Of Different Numbers Of CSA Practices

→ Upfront investment costs are a potential barrier to CSA adoption

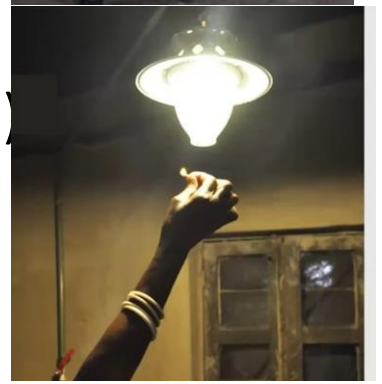




Source: Caulfield et al. report and manuscript under development

Case study 2: Africa Biogas Component (ABC) Kenya (2020-2025)

- 2.8 billion people worldwide (900 million in Sub-Saharan Africa) lack clean cooking fuels, leading to household air pollution and 2.8 million annual deaths, mostly affecting women and children.
- Biodigester turns manure into clean fuel (biogas) and fertilizer.
- Installed capacity of 18.5 million farm-scale digesters (93 million beneficiaries) in Africa.
- ABC aims to support commercial biodigester sector in Sub-Saharan Africa.
- Installation of at least 50,000 small scale biodigesters and 250 medium-scale bio-digesters .
- Providing energy access for at least 250,000 people and reducing GHG emissions of annually 180,000 tonnes of CO_2e.



Mitigate+: Research for Low-Emission Food Systems

Takeaways

- Current capabilities for monitoring mitigation and adaptation fall short of NDC goals
- Funding allocations for equipment and capacity building are inadequate to address existing gaps
- Development of local equations to estimate emissions is crucial for accurate inventories
- Optimizing production systems can lead to substantial benefits
- Tailoring CSA practices to specific livestock systems and ensuring adequate financing to lower barriers to adoption
- A collaborative approach at national and international levels, involving governments, researchers, donors, industry professionals, and farmers, is essential for success

Thank you very much for your attention!

Better lives through livestock

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