



More meat milk and eggs by and for the poor

Smallholder Dairy Development and Environmental Impacts in Tanzania

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Alliance of Bioversity International and CIAT

Maziwa Zaidi stakeholder workshop on environmental management opportunities for dairy in Tanzania, Arusha, Tanzania, 16 December 2020

Alliance



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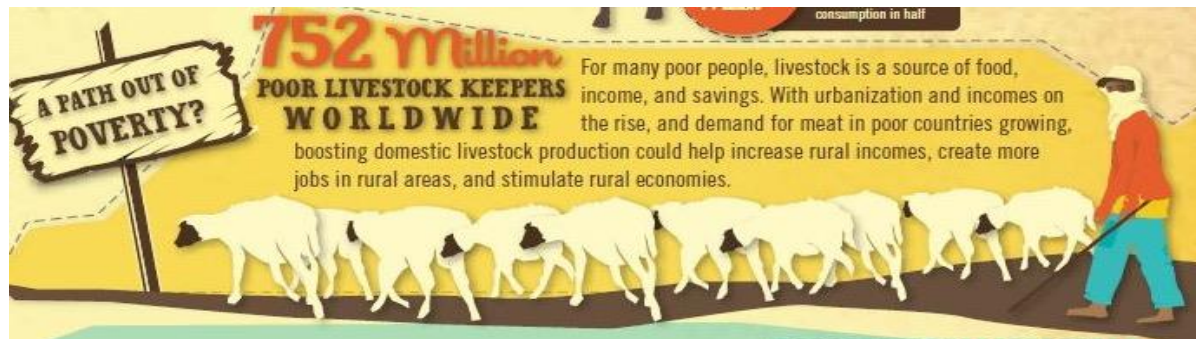
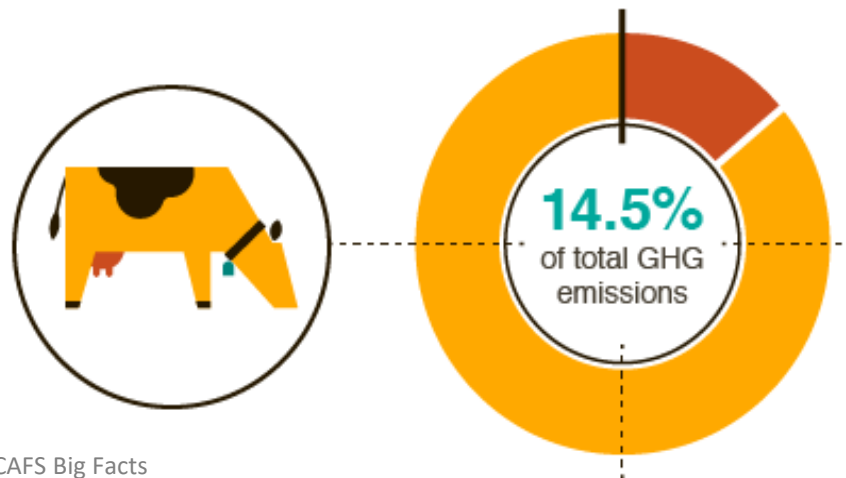
More Milk in Tanzania (MoreMilkIT) Project



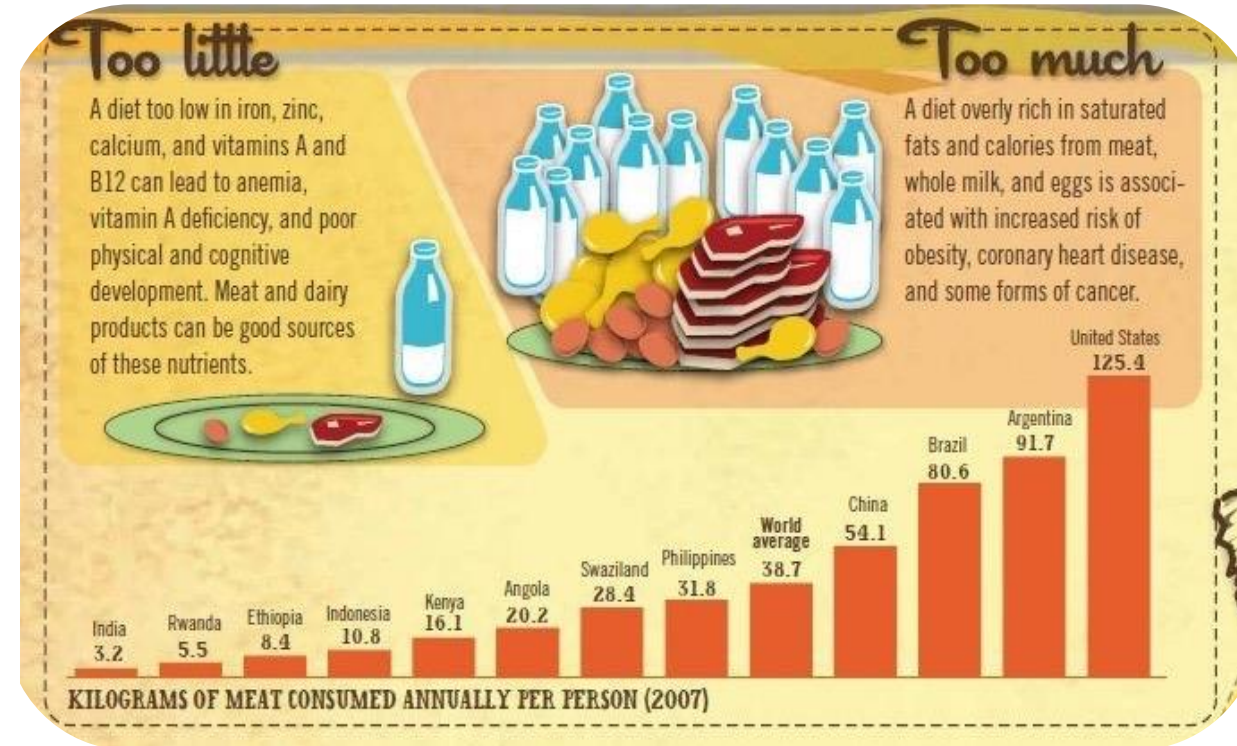


Livestock: the good, bad and complicated

Livestock contributes **7,100 MtCO₂e/year** or **14.5%** of total global GHG emissions.



ifpri Insights



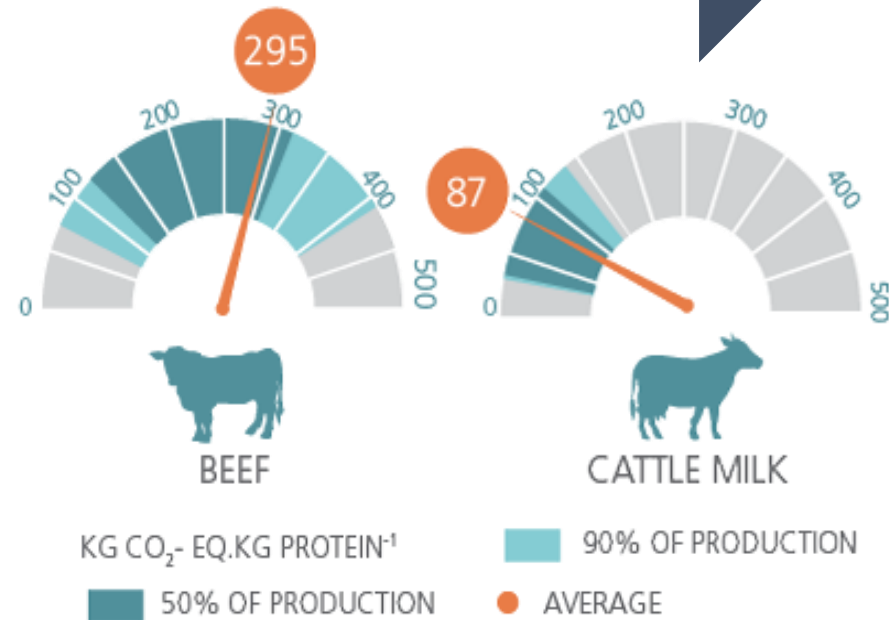
Low productivity and resource use inefficiencies

Poor feeding, husbandry, breeds, health...



...and causes high greenhouse gas emission intensities

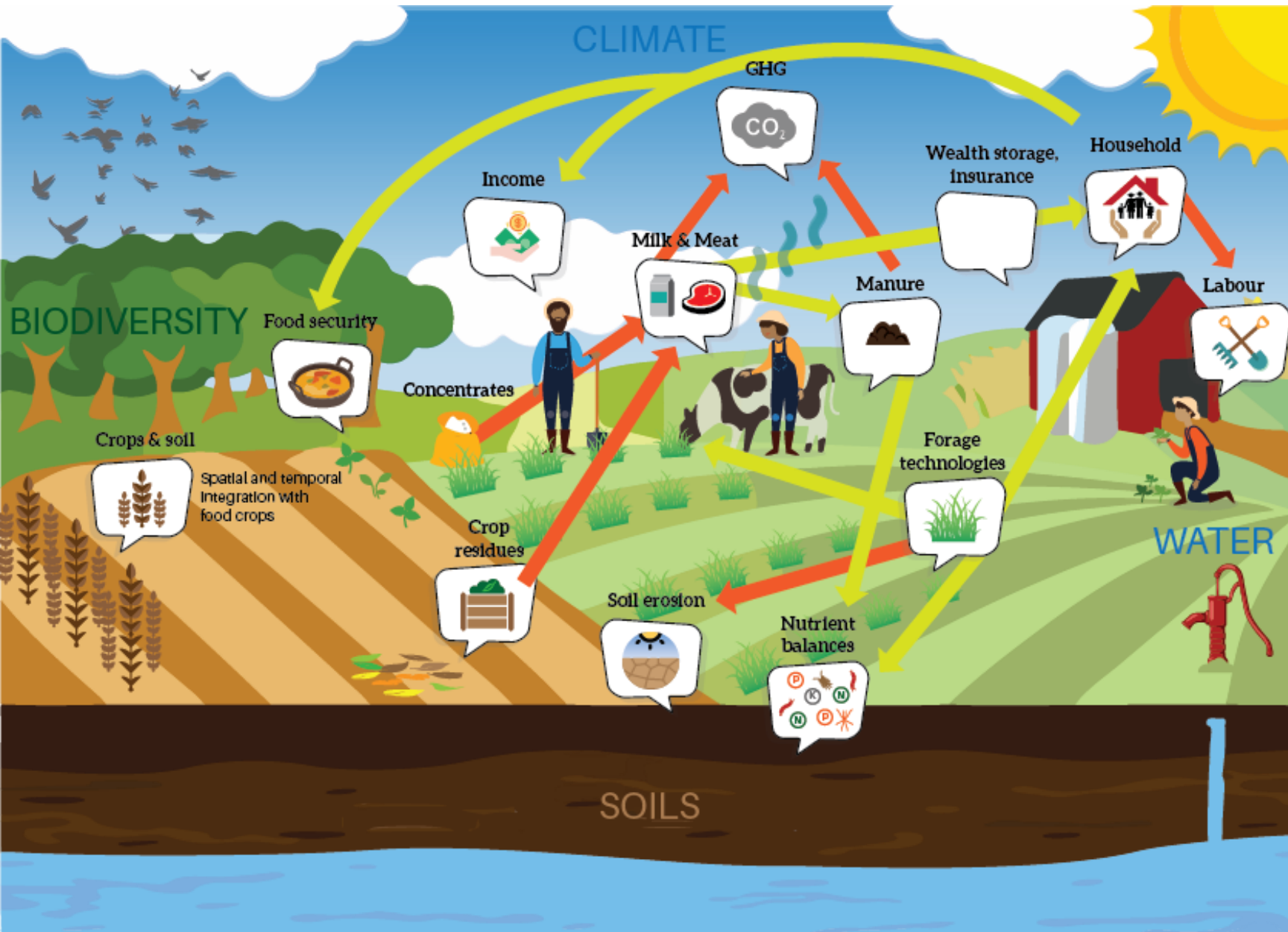
...limits milk productivity



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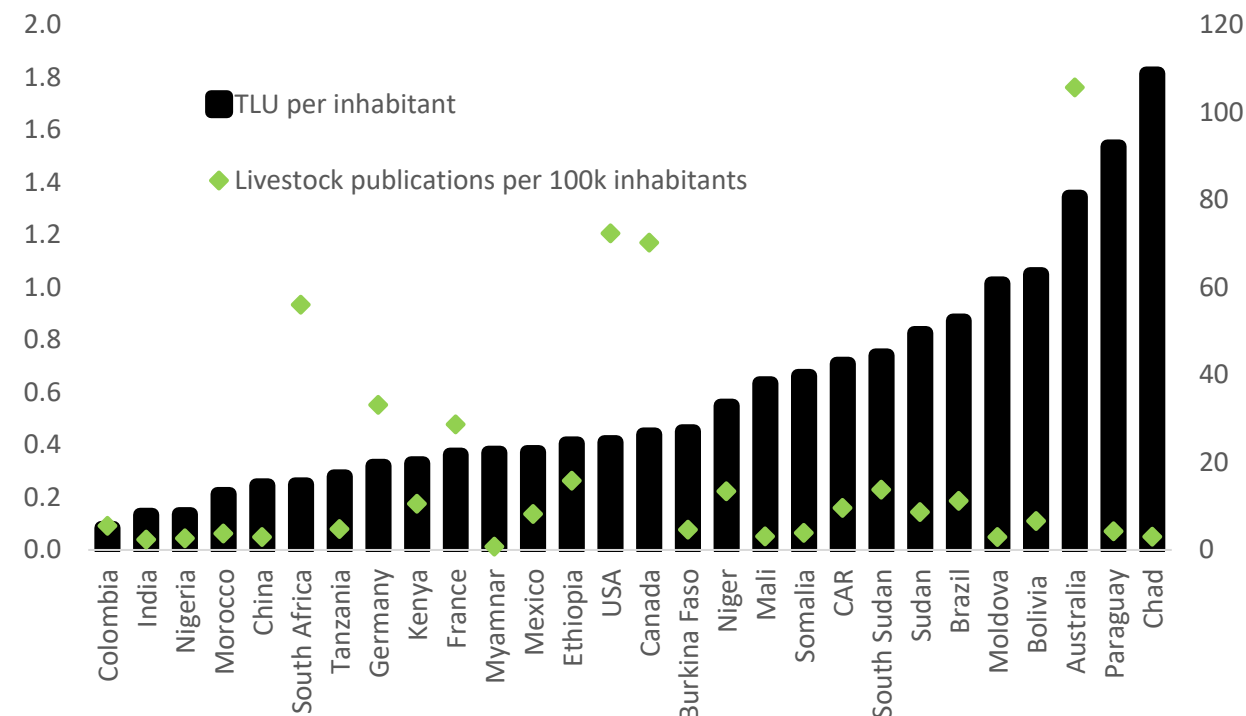
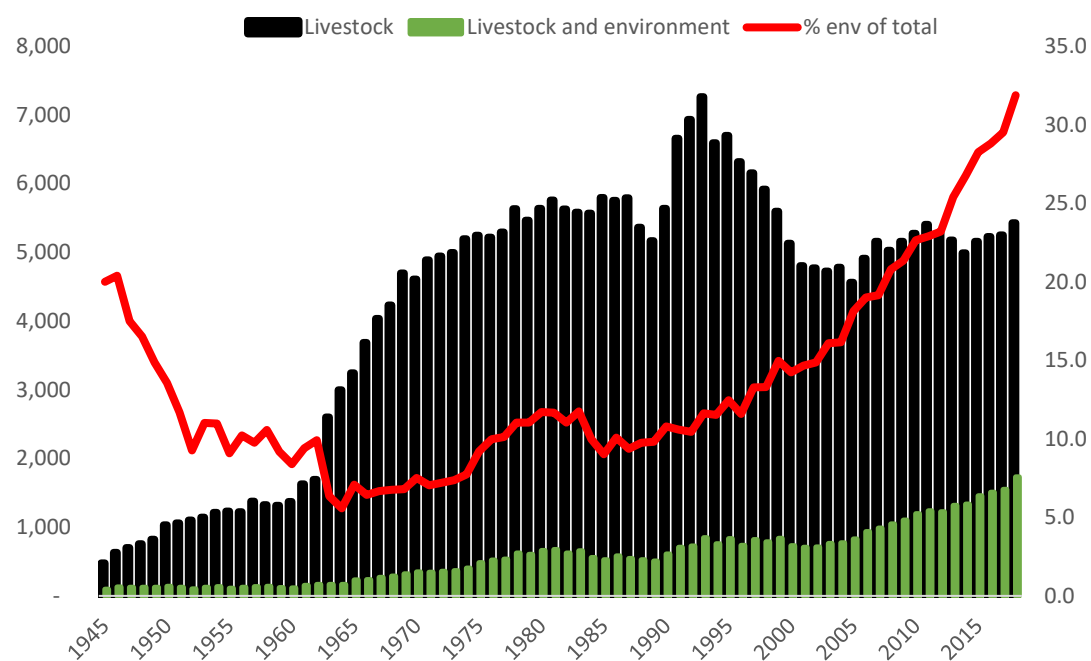
Sustainable livestock intensification



Diversity of integrated crop-livestock dairy systems, where manure, residues, forages link crop and livestock components.

Dairy development interventions can lead to trade-offs and synergies between various livelihood and environmental quality, including climate, soils, biodiversity and water.

Livestock and environment research from Africa is limited

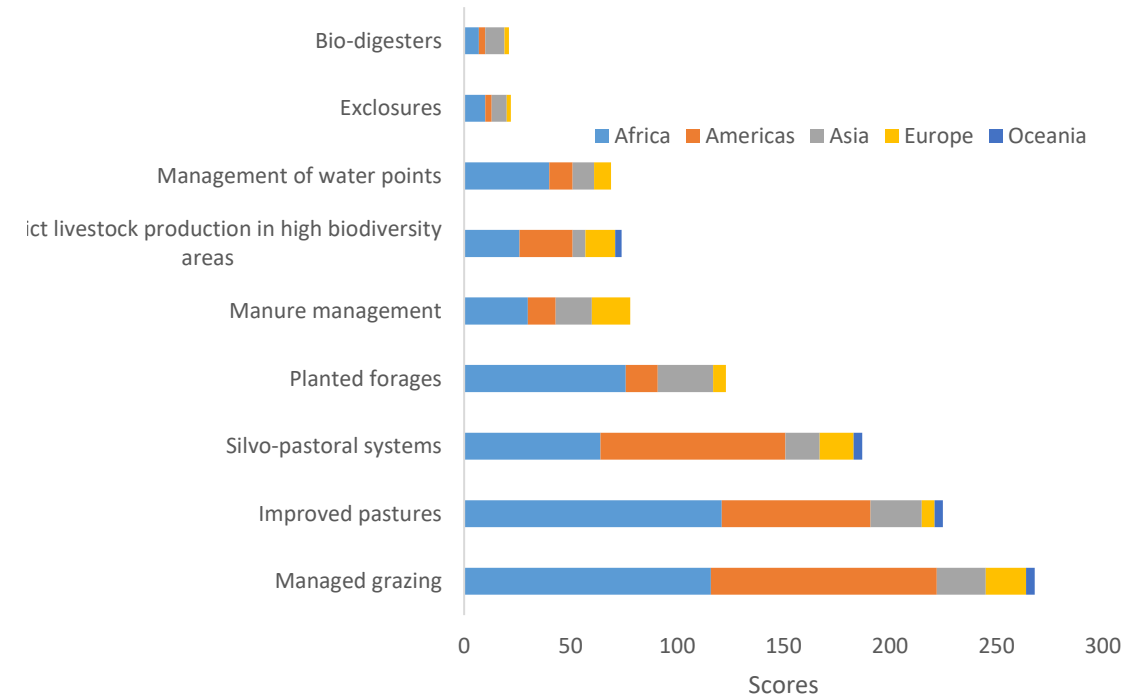
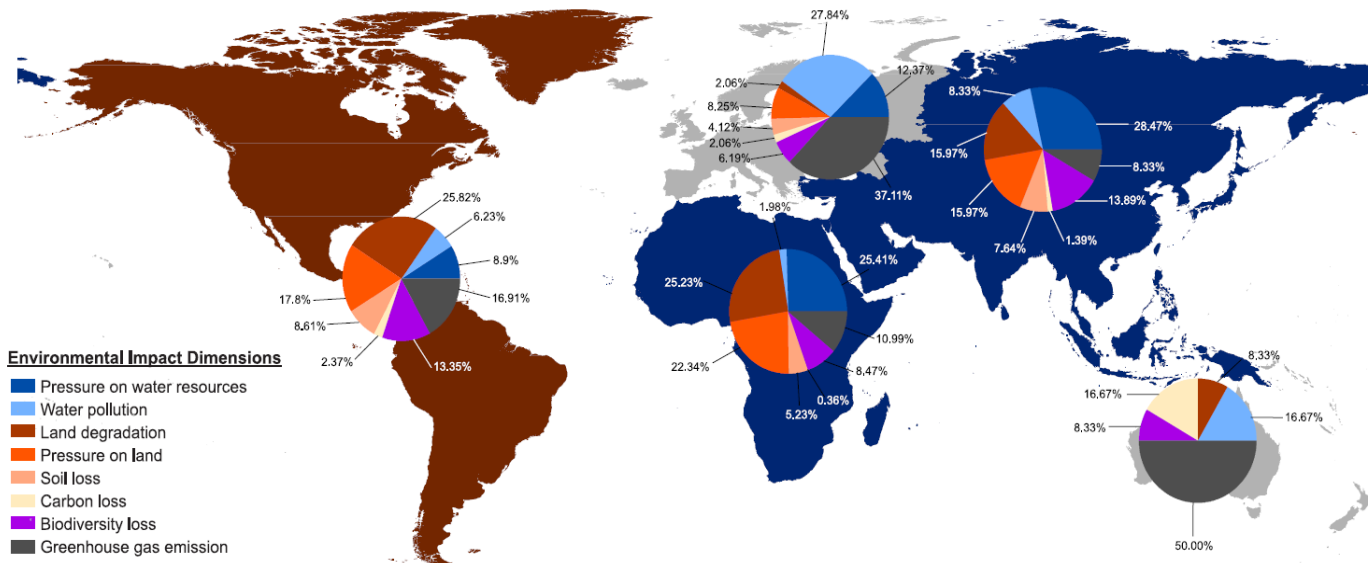


Paul, B.K., Butterbach-Bahl, K., Notenbaert, A., Nderi, A.N., Ericksen, P. (2020). Sustainable livestock development in low and middle income countries – shedding light on evidence-based solutions. *Environmental Research Letters*. <https://iopscience.iop.org/article/10.1088/1748-9326/abc278>

Environmental impacts and solutions – what experts say



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Paul, B.K., Butterbach-Bahl, K., Notenbaert, A., Nderi, A.N., Ericksen, P. (2020). Sustainable livestock development in low and middle income countries – shedding light on evidence-based solutions. *Environmental Research Letters*. <https://iopscience.iop.org/article/10.1088/1748-9326/abc278>



Tropical forages...



...and their multiple roles in cropping systems



But their uptake remains relatively low to date

Paul, B.K.; Groot, J.C.; Maass, B.L.; Notenbaert, A.M.; Herrero, M.; Tiftonell, P.A. (2020) Improved feeding and forages at a crossroads: Farming systems approaches for sustainable livestock development in East Africa. Outlook on Agriculture 8 p. <https://cgspace.cgiar.org/handle/10568/107432>

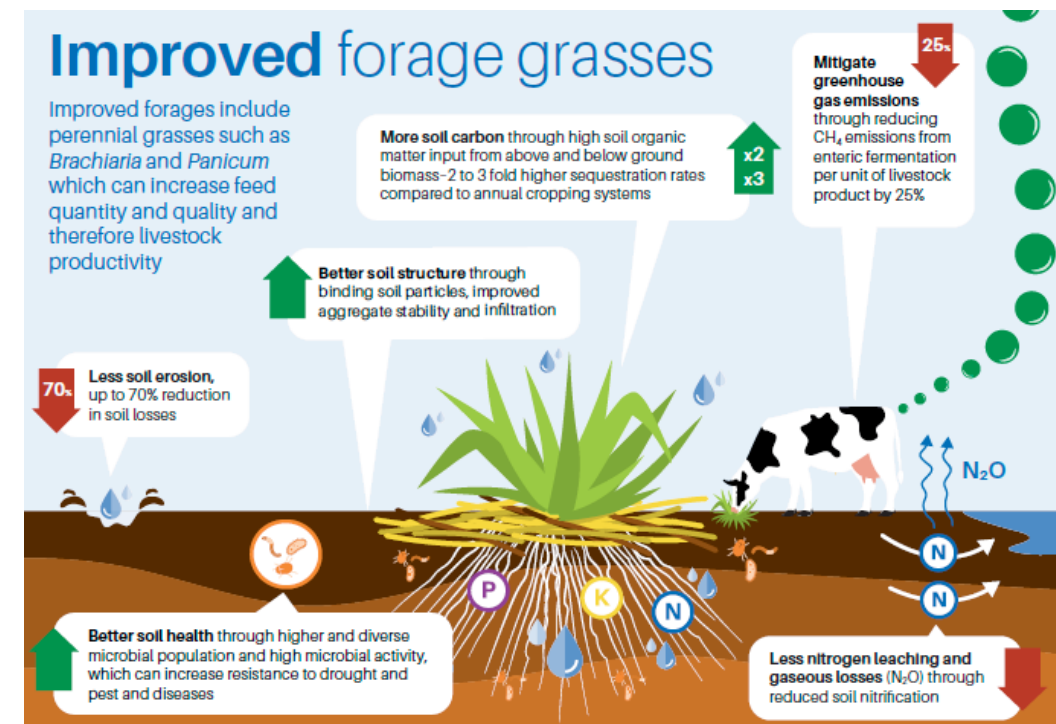
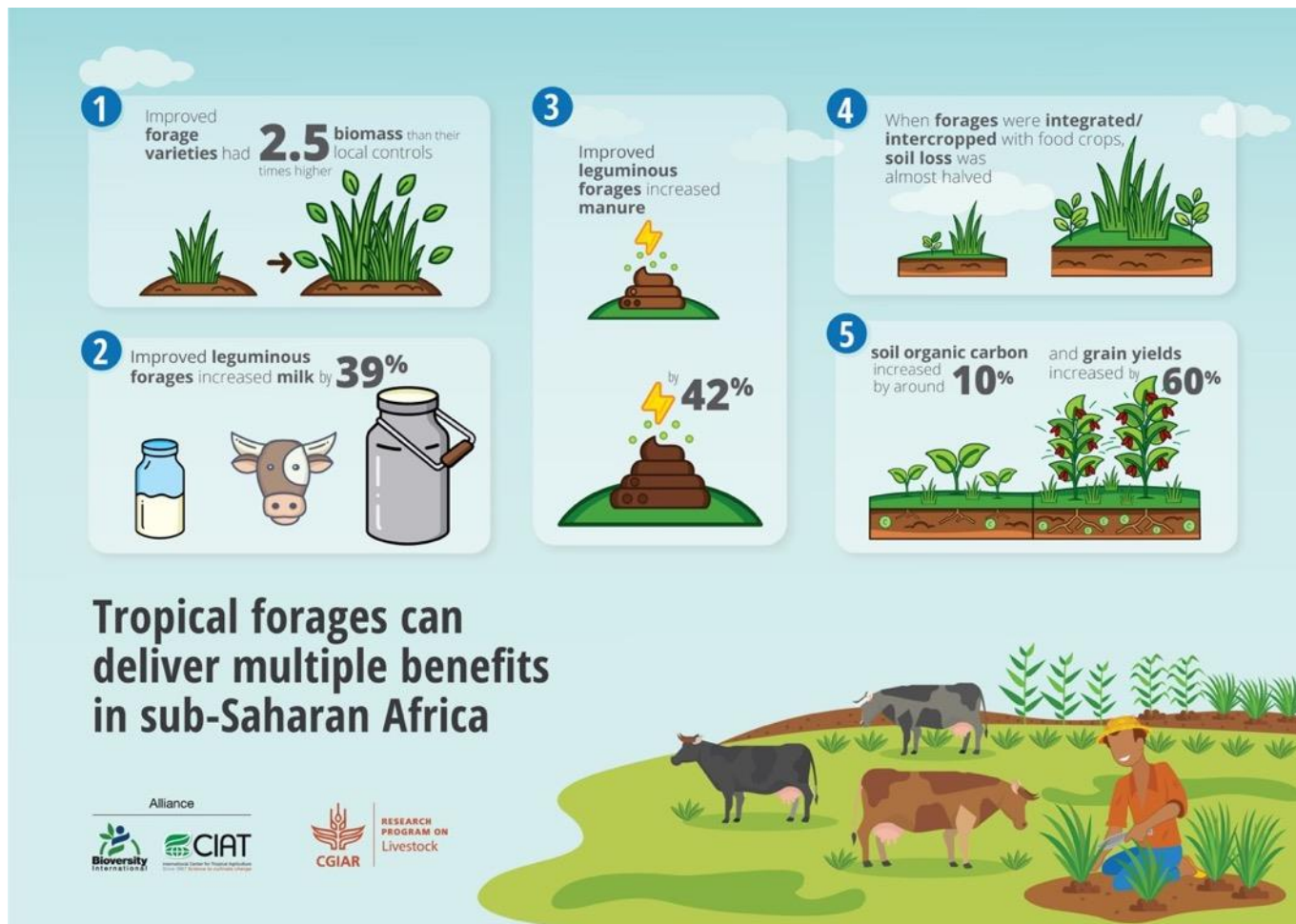


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Multiple, synergetic benefits of tropical forages



CIAT. 2019. Soil and climate benefits of improved forage grasses. International Center for Tropical Agriculture, Nairobi, Kenya. 1p. <https://hdl.handle.net/10568/107153>

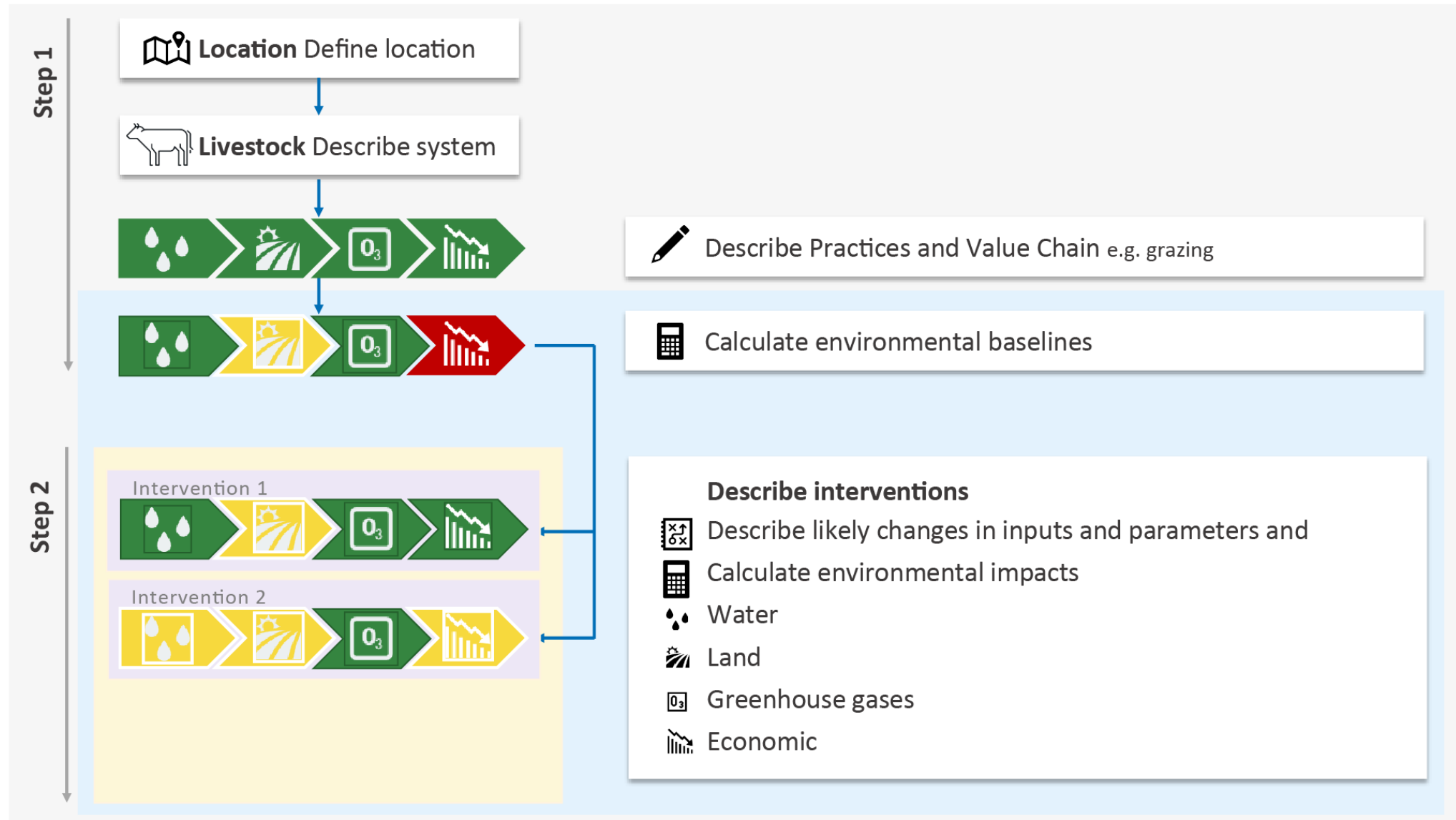
Paul, B.K.; Koge, J.; Maass, B.L.; Notenbaert, A.; Peters, M.; Groot, J.C.J.; Tittonell, P. (2020) Tropical forage technologies can deliver multiple benefits in Sub-Saharan Africa. A meta-analysis. *Agronomy for Sustainable Development* 40:22. <https://hdl.handle.net/10568/108642>



Livestock & environment
research in Tanzania:
Snapshots 2015-2020

CLEANED

A rapid ex-ante environmental impact assessment tool that lets users explore multiple impacts of intensifying livestock value chains



Flagging environmental impacts with CLEANED in Tanga region ...



		Productivity		Land requirements		Erosion			Nutrients			GHG emissions		
		Total supply (FPCM)	Productivity (FPCM/ha)	Land used (ha)	Land used per product (ha/MT FPCM)	Soil lost (kg)	Soil lost per area (kg/ha)	Soil lost per product (kg/MT FPCM)	N lost (kg)	N lost per area (kg/ha)	N lost per product (kg/kg FPCM)	Total emissions (kg CO2-eq)	Emissions per area (kg CO2-eq/ha)	Emissions per product (kg CO2-eq/MT FPCM)
Mixed crop-livestock enterprise	Genetics		-	-	-	-		-	-		-	-		-
	Feed	+++	+	---	+	---	+	++	---	+	++	---	-	
	Health	+++	+	---	+	---		+	---	+	+	---		+
	Combined	+++	++	---	++	---	+	++	---	+	++	---	-	+
Agro-pastoral enterprise	Genetics	++	+++	++	++	++		++	++		+++	+	-	++
	Feed	++	+++	++	+++	++	+	+++	++		+++	--	---	+
	Health	++	+++	++	+++	++	+	+++	++		+++	--	---	+
	Combined	+++	+++	-	++	-	+	+++	-	-	+++	--	-	++
Tanga VC	Genetics	+	++	+	+		-	+		-	+		-	+
	Feed	++	+++	+	++	+		++	+	-	++	--	---	+
	Health	++	++	+	++	+		++		-	++	--	---	
	Combined	+++	+++	-	++	-	+	++	-	+	++	--	-	+

- Economically feasible farm-level productivity increases of up to 140% go hand-in-hand up to 50% reduction in greenhouse gas (GHG) emission intensities
- Absolute increases in water, land and nitrogen requirements in mixed crop-livestock systems call for careful management of stocks and quality of these resources

Notenbaert, A., Groot, J.C.J., Herrero, M., Birnholz, C., Paul, B.K., Pfeifer, C., Fraval, S., Lannerstad, M., McFadzean, J., Dungait, J., Morries, J., Ran, Y., Barron, J., Titttonell, P. (2020). Towards environmentally sound intensification pathways for dairy development in the Tanga region of Tanzania.

<https://hdl.handle.net/10568/110323>



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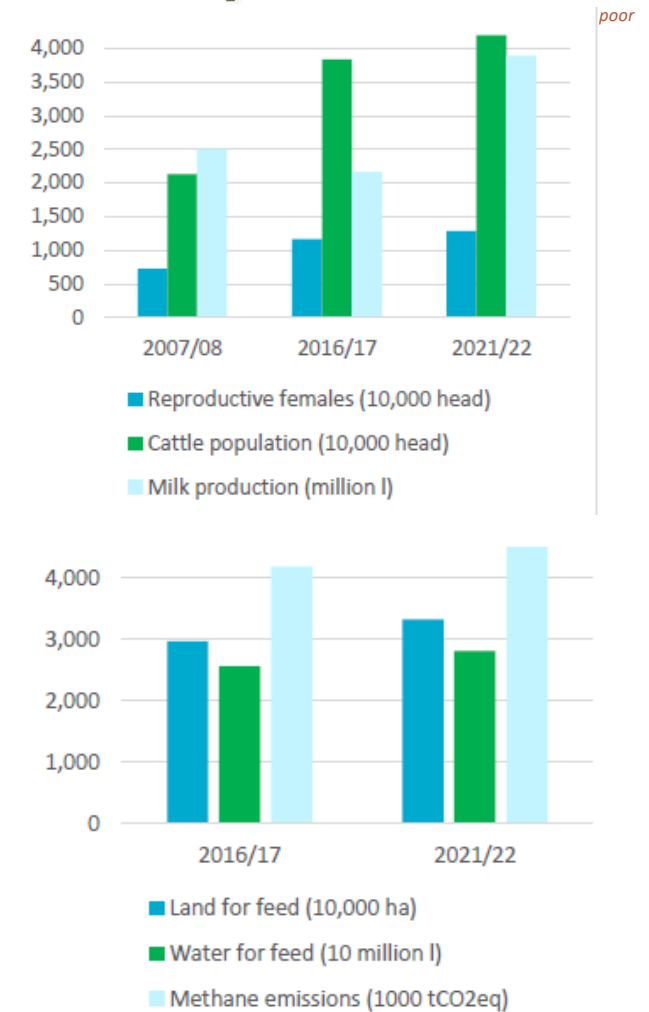
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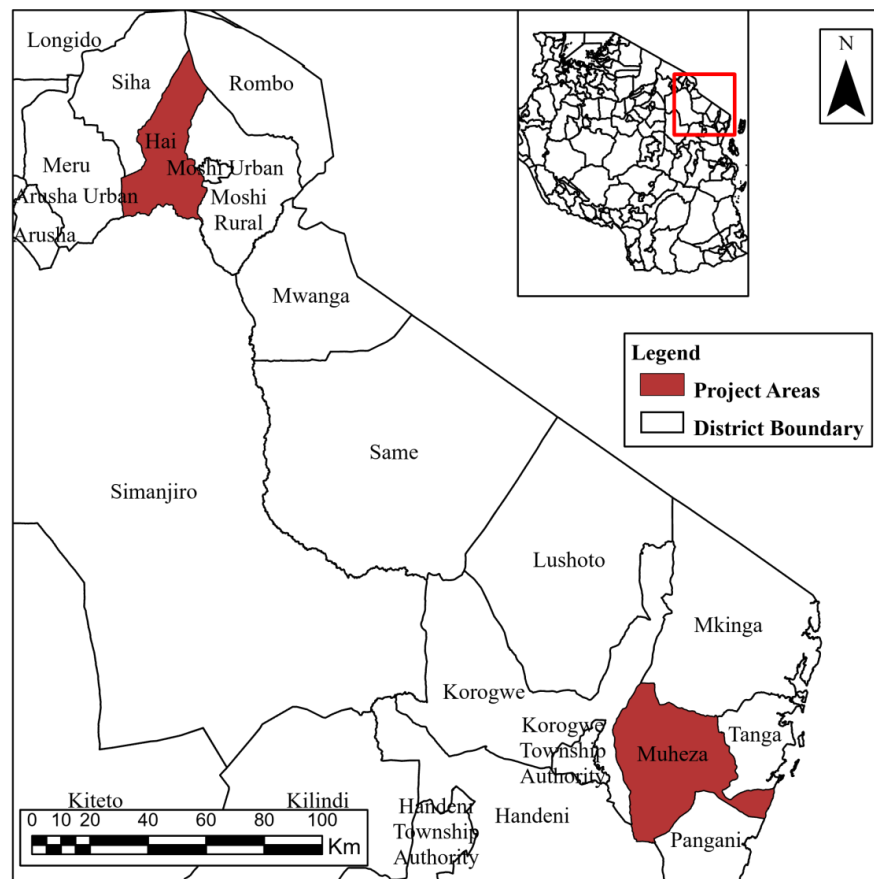
...and at national level in Tanzania...



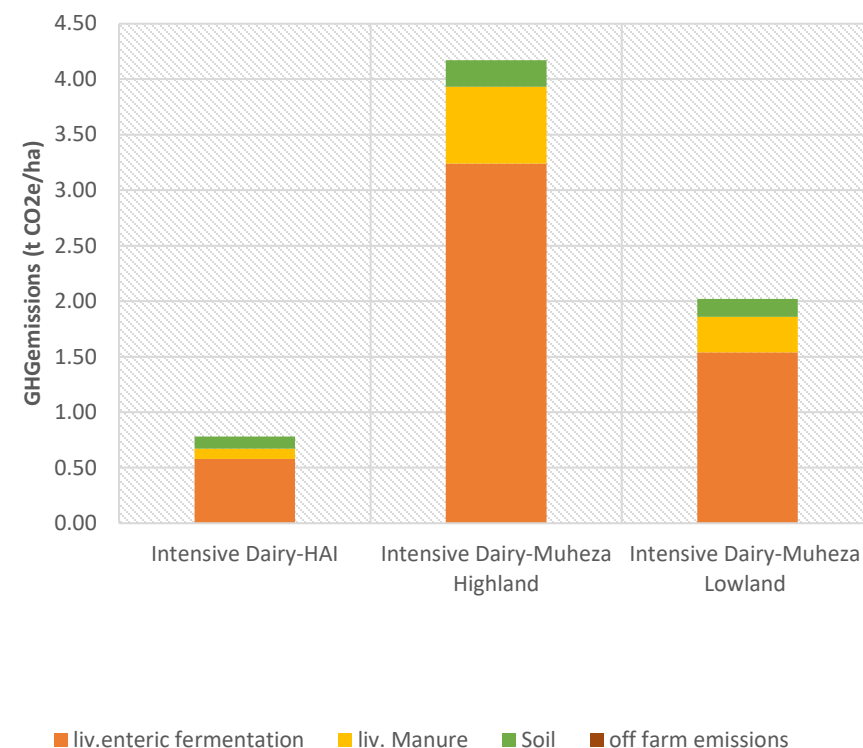
- The Livestock Master Plan projects an increase number of reproductive females and national milk production by 80% from 2016/17 to 2021/22
- If improved livestock feeding alone (e.g. improved Brachiaria grasses, Desmodium and Rhodes grass hay) is to deliver this milk increase, the following is projected:
 - *Methane emissions* increase by 11% to 4.6 Mt CO₂e, but methane emission intensity decreases from 2.5 to 1.9 kg CO₂e/kg milk
 - *Land* required to produce feed increases by 12% to 33.3 Mio ha, but land required per unit milk decreases from 0.6 to 0.4 ha/kg milk
 - *Water* required to produce feed increases by 9% to 28.2 billion liter, but water required by unit milk decreases from 0.5 to 0.4 l/kg milk



...with more to come on Tanga/Kilimanjaro regions under MaziwaZaidi II

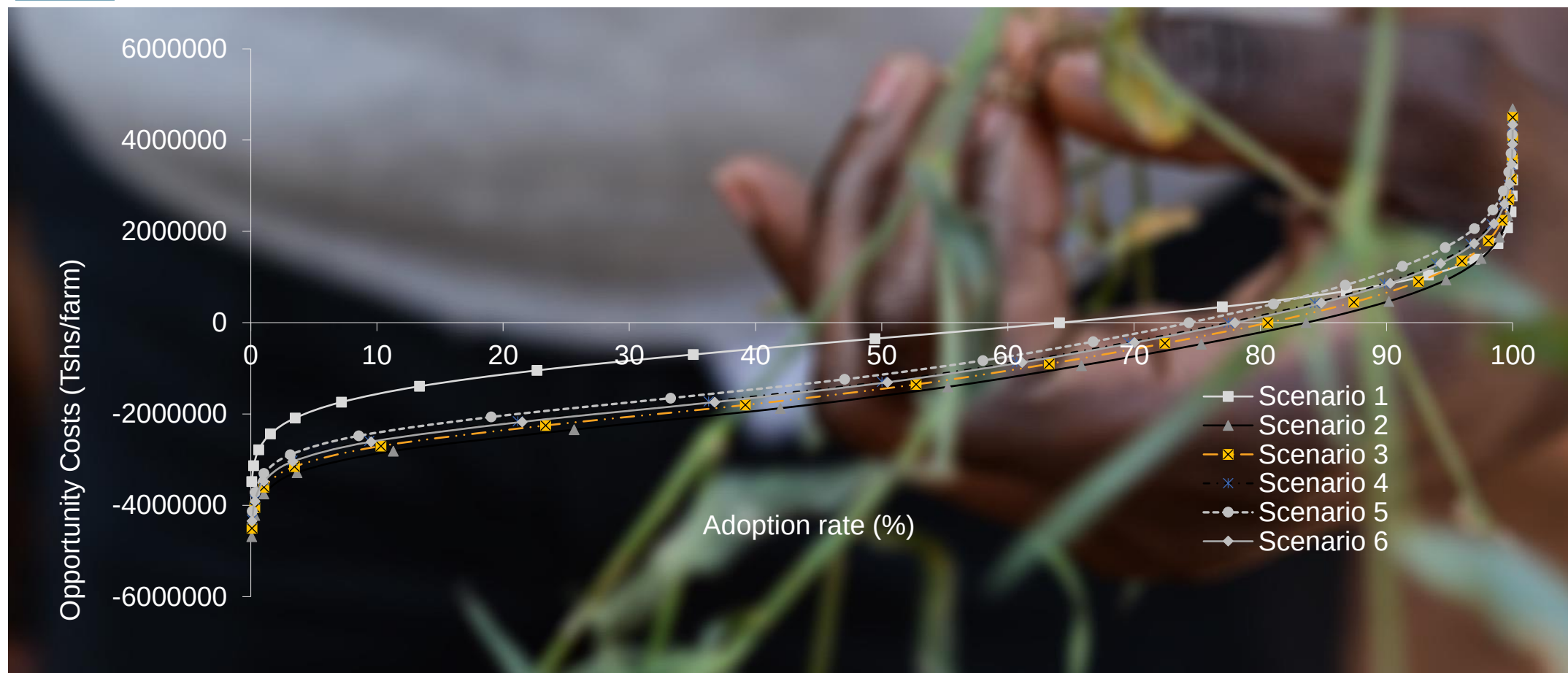


Greenhouse gas emissions (IPCC Tier 2)





Climate-smart livestock in Lushoto, Tanga



Shikuku, K.M., Valdivia, R., Paul, B.K., Mwongera, C., Winowiecki, L., Laderach, P., Herrero, M., Silvestri, S. (2017). Prioritizing climate-smart livestock technologies in rural Tanzania: A minimum data approach. *Agricultural Systems*, 151, 204-216.

<https://hdl.handle.net/10568/75727>

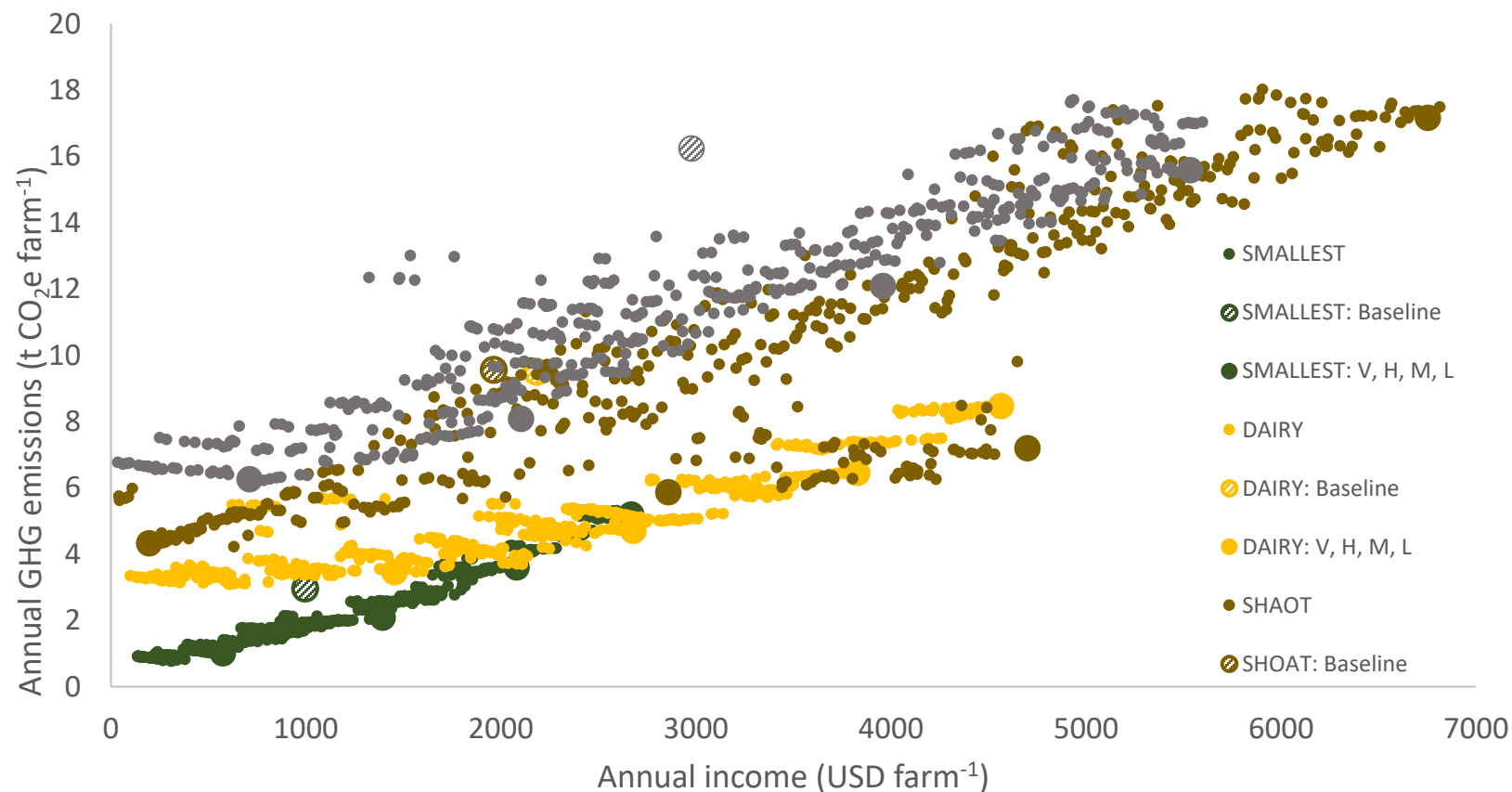


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Trade-offs between income and GHG in Babati, Manyara region



Paul, B.K., Groot, J.C.J., Birnholz, C.A., Nzogela, B., Notenbaert, A., Woyessa, K., Sommer, R., Nijbroek, R., Tiftonell, P. (2020). Reducing agro-environmental trade-offs through sustainable livestock intensification across smallholder systems in Northern Tanzania. *International Journal for Agricultural Sustainability*, 18(1), 35-54. <https://cgspace.cgiar.org/handle/10568/106025>

Key messages

1. Positive and negative impacts of livestock are two sides of the same coin
2. Efficiency and environmental gains are linked
3. We need multidisciplinary, applied agri-food systems research to address challenges
4. Environment is not all about climate, but also water, soils and biodiversity
5. Research on livestock and the environment still scarce in Africa and Tanzania, though some progress has been made under Maziwa Zaidi
6. Synergies between livelihood and environmental objectives are possible –
> sustainable livestock intensification
7. Solutions for sustainable livestock intensification exist, including improved livestock feeding and forages, but need wide-scale uptake
8. Climate-smart livestock intensification options should be a building block of Tanzania's climate and livestock policies
9. Research needs to be embedded in appropriate financial incentives, institutional settings and capacity building of involved stakeholders



More reading

All journal publications (open access)

1. [Prioritizing climate-smart livestock technologies in rural Tanzania: a minimum data approach \(cgiar.org\)](#)
2. [Improved feeding and forages at a crossroads: Farming systems approaches for sustainable livestock development in East Africa \(cgiar.org\)](#)
3. [Sustainable livestock development in low and middle income countries - shedding light on evidence-based solutions – IOPscience](#)
4. [Tropical forage technologies can deliver multiple benefits in Sub-Saharan Africa. A meta-analysis \(cgiar.org\)](#)
5. [Reducing agro-environmental trade-offs through sustainable livestock intensification across smallholder systems in Northern Tanzania \(cgiar.org\)](#)
6. [Towards environmentally sound intensification pathways for dairy development in the Tanga region of Tanzania \(cgiar.org\)](#)

Blogposts & websites

CIAT Blog (2018). Low emission livestock – how to quantify gains across Africa?

<https://blog.ciat.cgiar.org/low-emission-livestock-how-to-quantify-gains-across-africa/>

CIAT Blog (2016). An unlikely weapon against poverty and drought. <https://blog.ciat.cgiar.org/an-unlikely-weapon-against-poverty-and-drought/>

CIAT Blog (2016). Livestock: Climate menace or opportunity for change?

<https://blog.ciat.cgiar.org/livestock-climate-menace-or-opportunity-for-change/>

CLEANED website: <https://ciat.cgiar.org/ciat-projects/environmental-assessments-of-livestock-systems-using/>



CGIAR Research Program on Livestock

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The **CGIAR Research Program on Livestock** aims to increase the productivity and profitability of livestock agri-food systems in sustainable ways, making meat, milk and eggs more available and affordable across the developing world.

livestock.cgiar.org



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