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MAZIWA ZAIDI

Productivity, environmental impacts and tradeoffs of livestock intensification options in Tanga region, Tanzania

10th of December 2015, 3rd Tanga Dairy Stakeholders' platform meeting

Birthe Paul, An Notenbaert, Catherine Pfeifer, Joanne Morris, Julius Bwire, Amos Omore – and many more contributors

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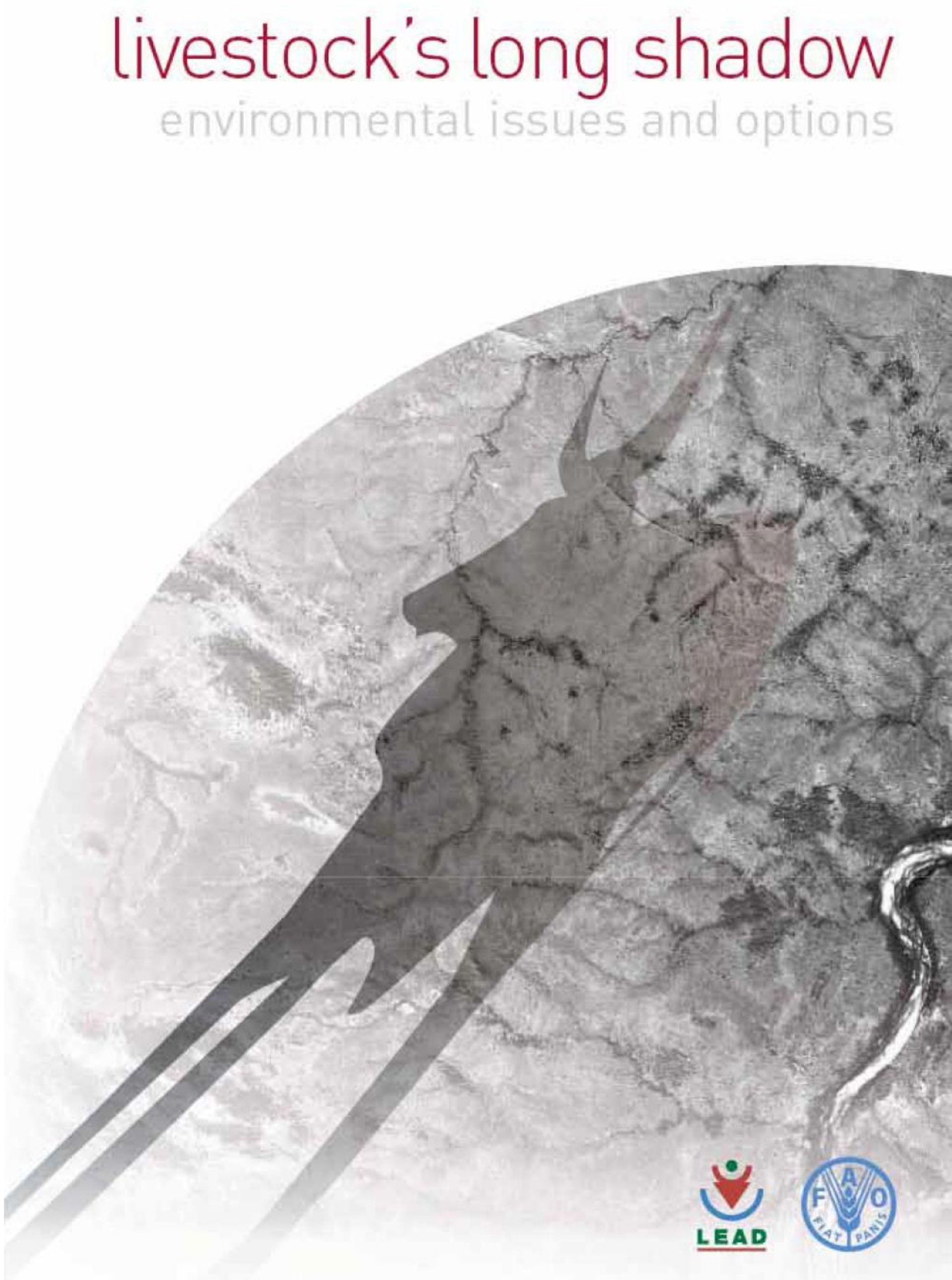
Presentation outline

1. Potential environmental impact assessment
2. Forage technologies and productivity
3. Conclusions

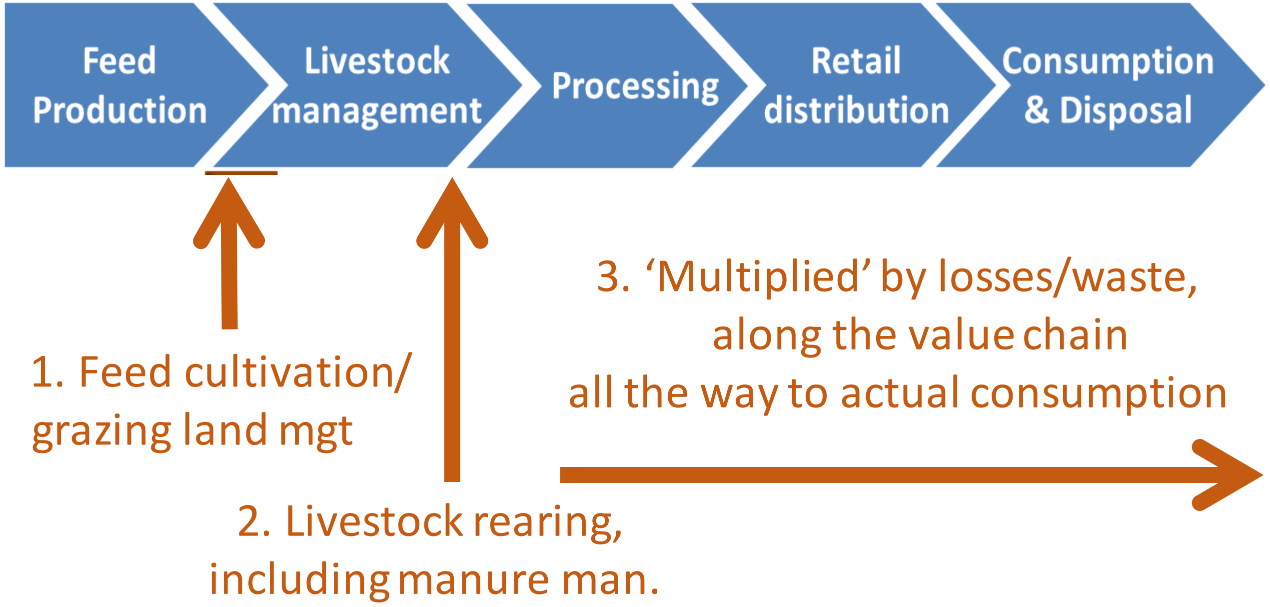
Picture: Neil Palmer, CIAT

Environment, modeling and tradeoffs

- Livestock's environmental impacts are widely discussed
- Farmers often face tradeoffs, eg between production and environment
- They influence adoptability, impact and sustainability of interventions
- There is no one silver bullet, capturing diversity is key
- Modeling needed to assess potential impacts (what-if)
- Ex-ante impact assessment can provide decision support



Environmental impacts along the value chain



Greatest environmental impacts = 1 + 2

1. Water availability and quality
   - Available water
2. Soil and land health:
   - Soil erosion
   - Soil fertility
3. GHG emissions:
   - Methane, nitrous oxide, carbon dioxide
4. Biodiversity loss:
   - Species diversity

Long-term sustainability needs to be assessed before designing large-scale livestock development projects. Quick ex-ante environmental impact assessment needed!

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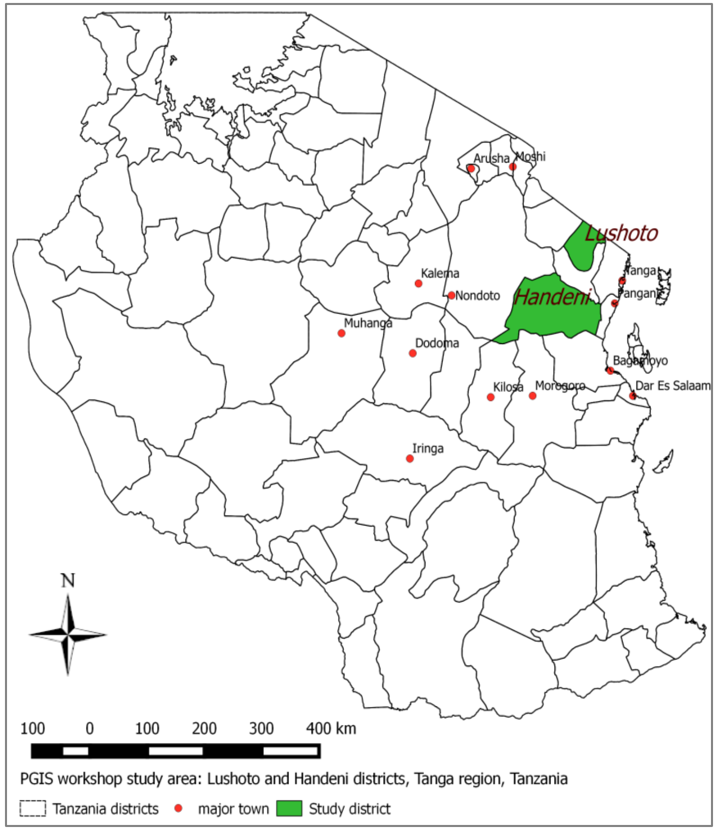
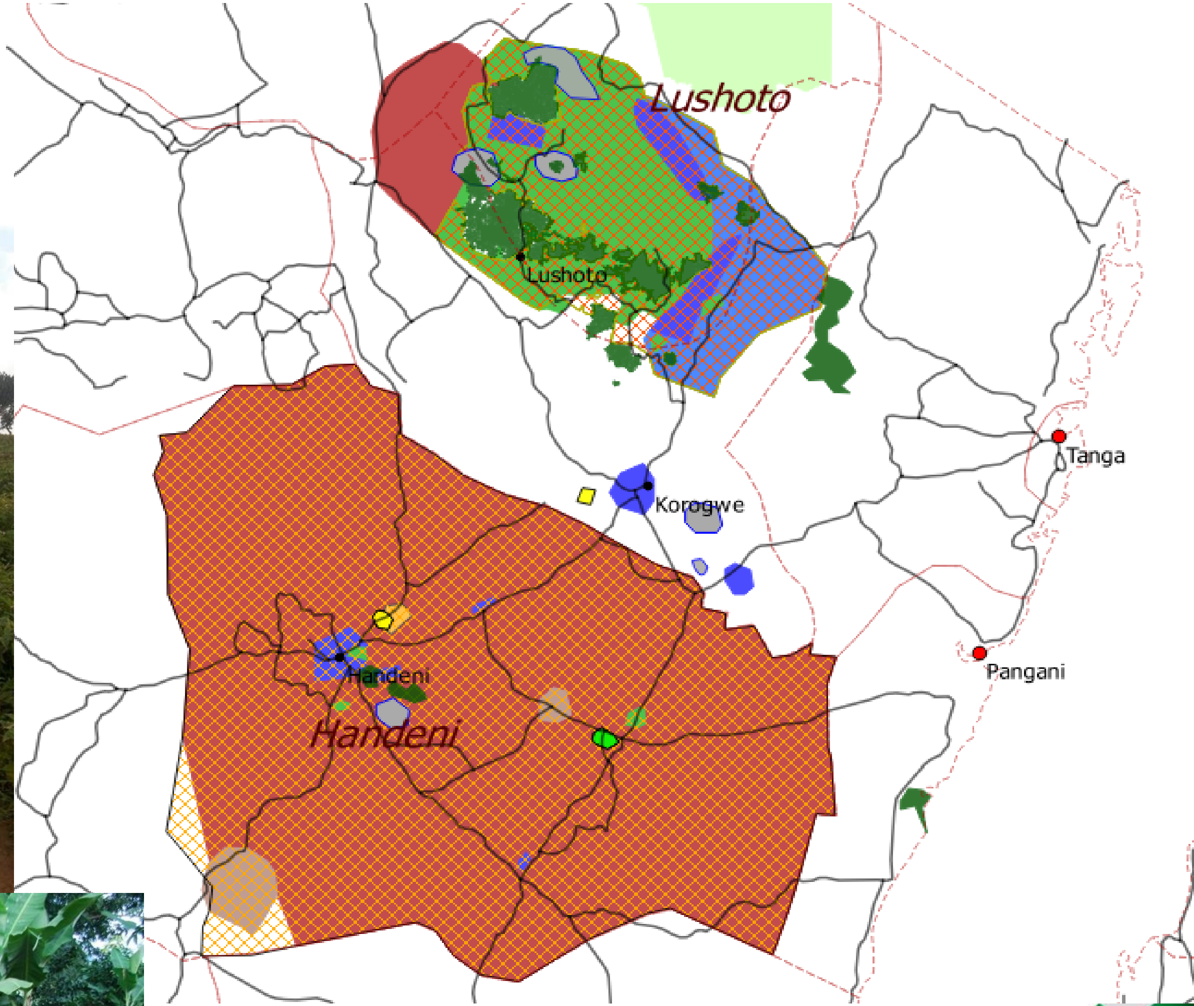
Farming systems in Tanga





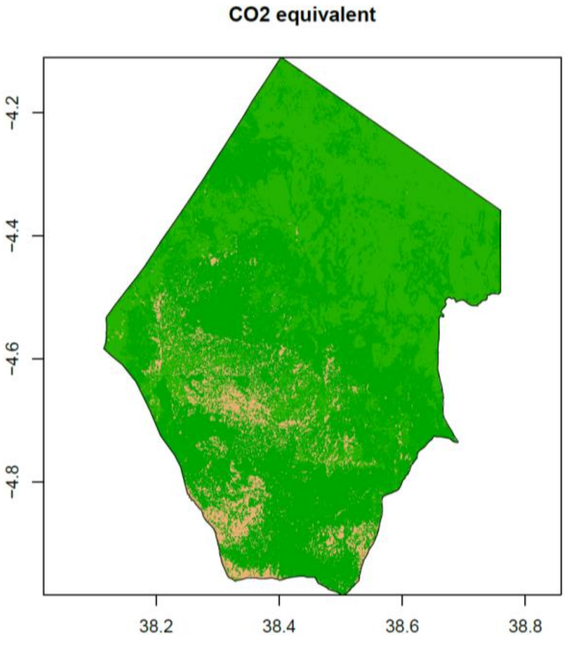
Participatory GIS workshop in June 2014 in Lushoto

Scenario parameters

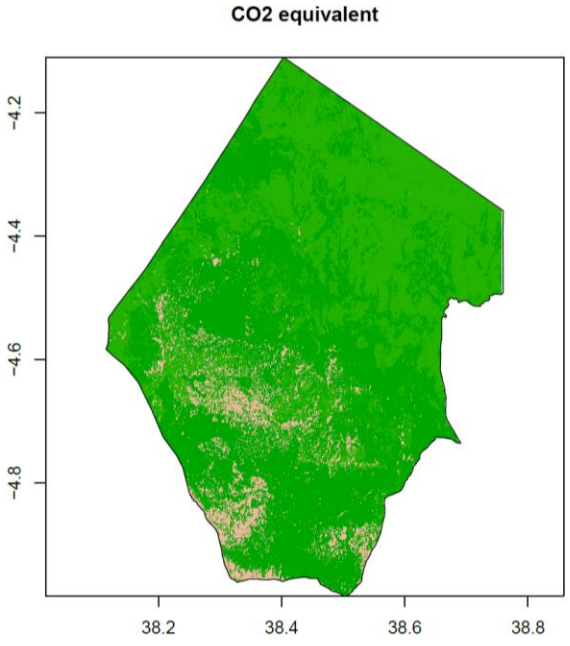
	Baseline	Feed scenario	Genetics scenario	Animal health scenario
Herd composition: Extensive (e) Semi-intensive (si)	 84% 16%	 84% 16%	 84% 16%	 76% 24%
Herd size increase	1	1	1	+80%
Liveweight increase	0% (e) 0% (si)	+7% (e) +6% (si)	+29% (e) +11% (si)	+14% (e) +6% (si)
Milk yield increase	0% (e) 0% (si)	+25% (e) +12% (si)	+50% (e) +4% (si)	+31% (e) +12% (si)

Feed basket %:	Baseline (e)	Baseline (si)	Feed scenario (e)	Feed scenario (si)	Genetics scenario	Animal health scenario
natural pasture	51	45	41	40		
maize residue	49	31	39	26		
planted fodder		12	20	12		
maize bran		5		5		
oil seed concentr.		7		7		
hay				10		

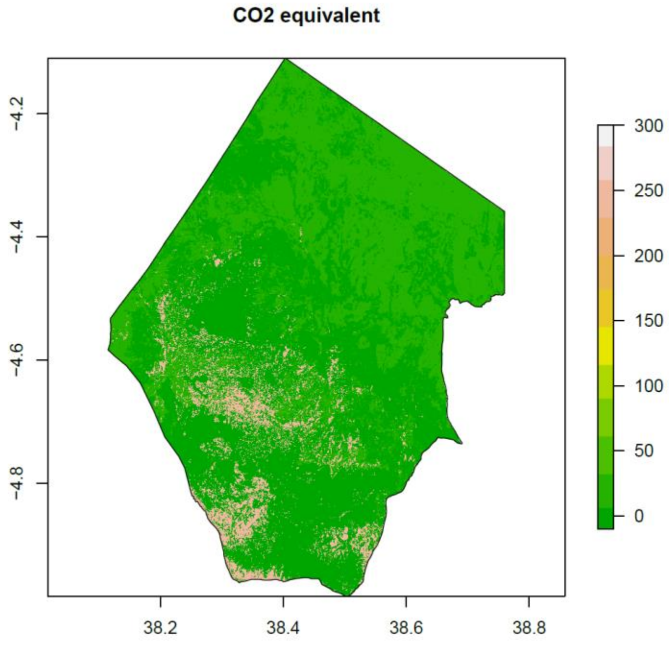
Scenarios based on Maziwa Zaidi village development plans



Baseline



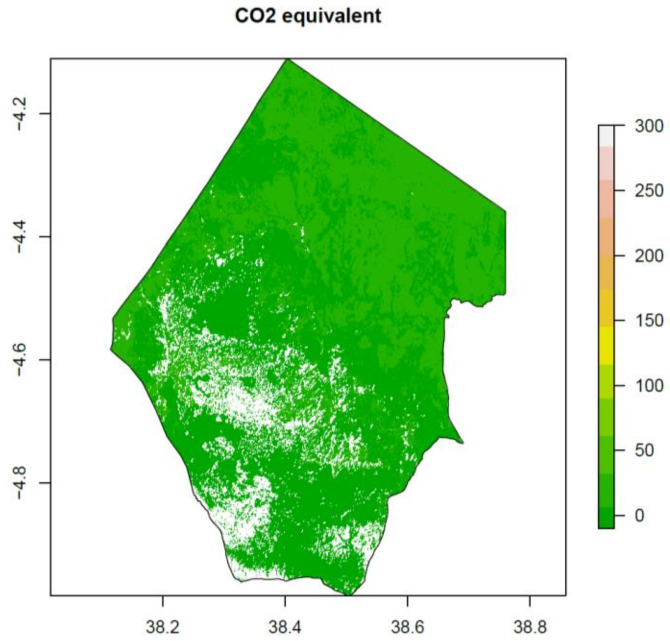
Feed scenario



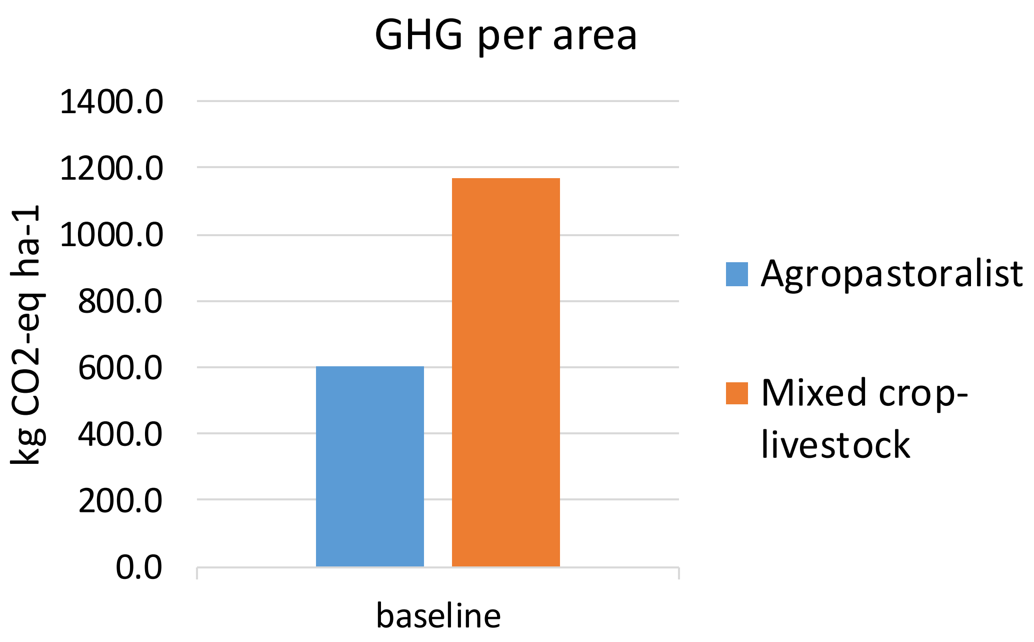
Genetics scenario

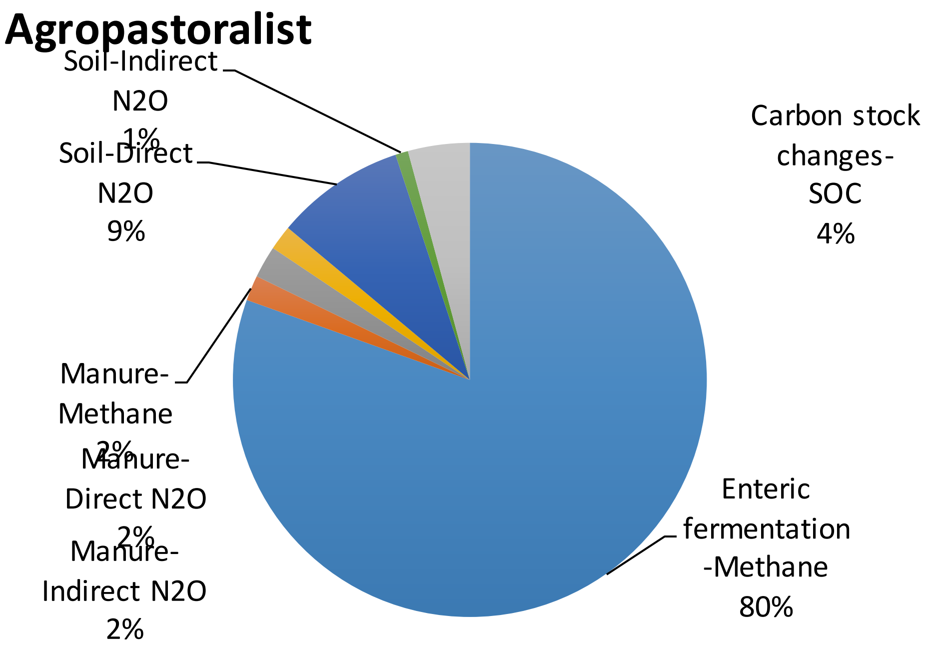
Greenhouse gases

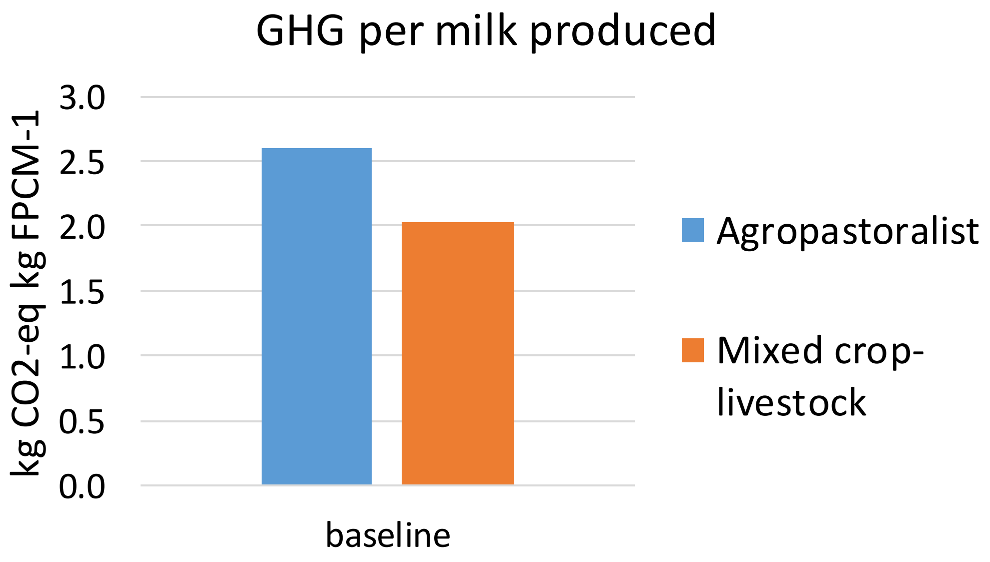
- Indicated by: carbon dioxide equivalents
- GHG change mainly driven by changing animal numbers

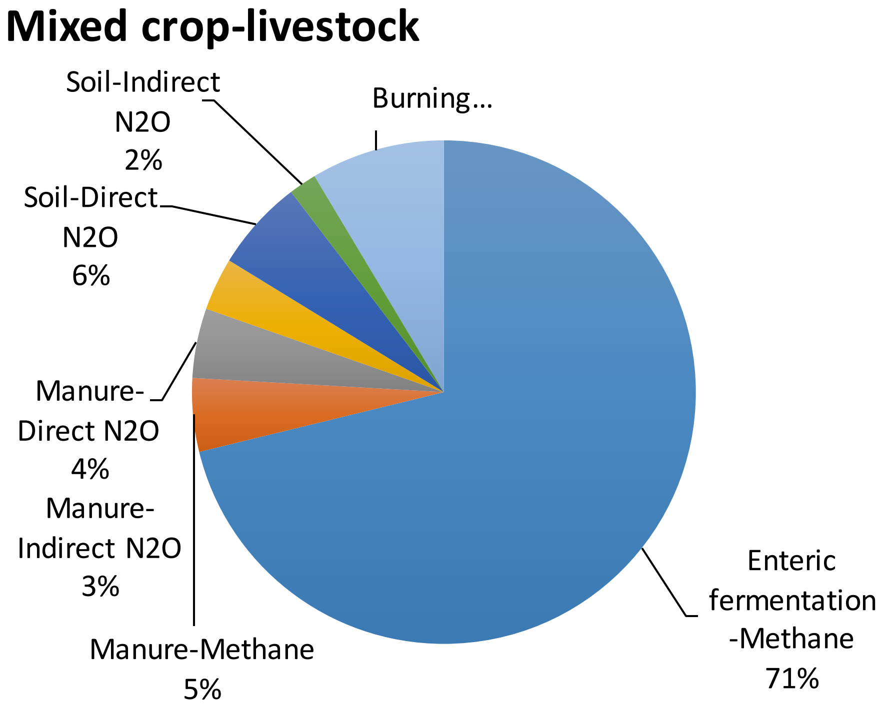


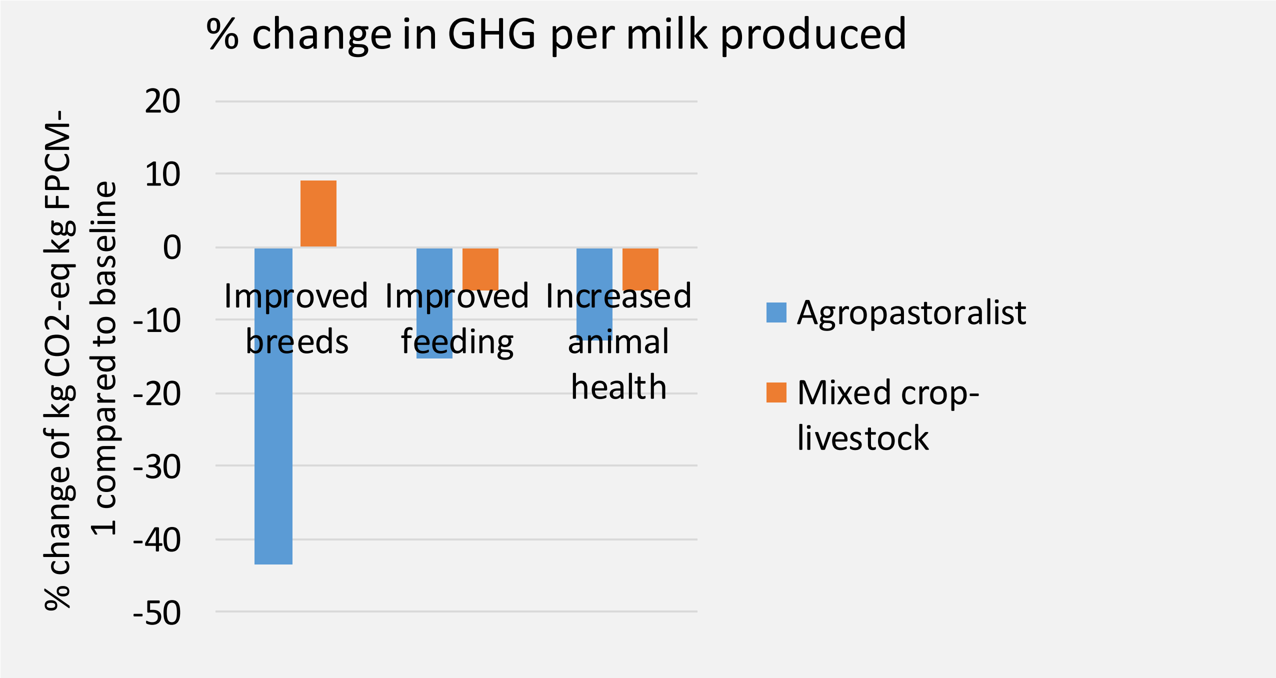
Animal health scenario

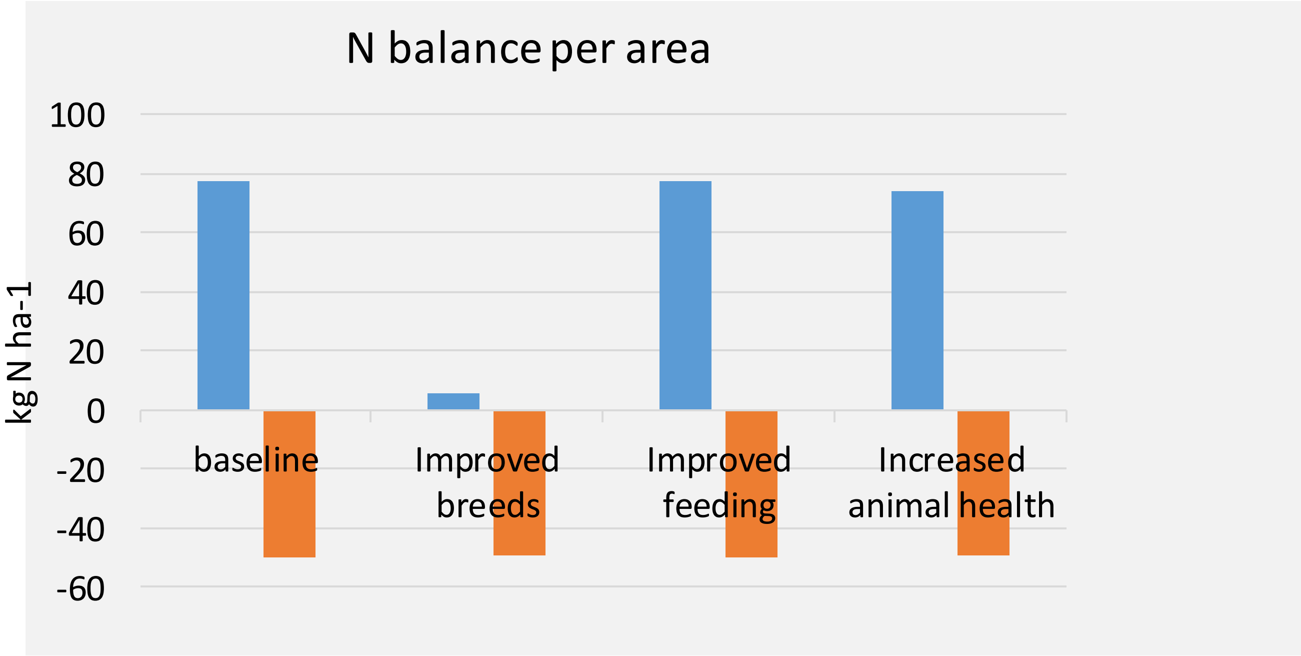

GHG per area
kg CO2-eq ha-1
1400.0
1200.0
1000.0
800.0
600.0
400.0
200.0
0.0
baseline
Agropastoralist
Mixed crop-livestock

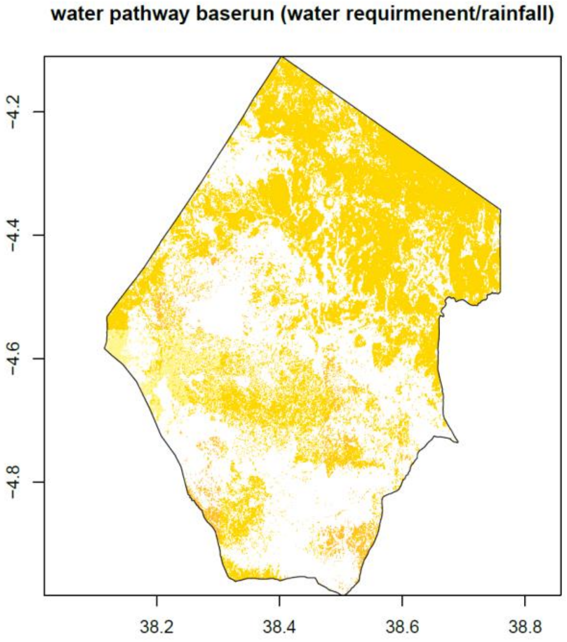

Agropastoralist
Soil-Indirect N2O 1%
Soil-Direct N2O 9%
Manure-Methane 2%
Manure-Direct N2O 2%
Manure-Indirect N2O 2%
Carbon stock changes-SOC 4%
Enteric fermentation-Methane 80%


GHG per milk produced
kg CO2-eq kg FPCM-1
3.0
2.5
2.0
1.5
1.0
0.5
0.0
baseline
Agropastoralist
Mixed crop-livestock

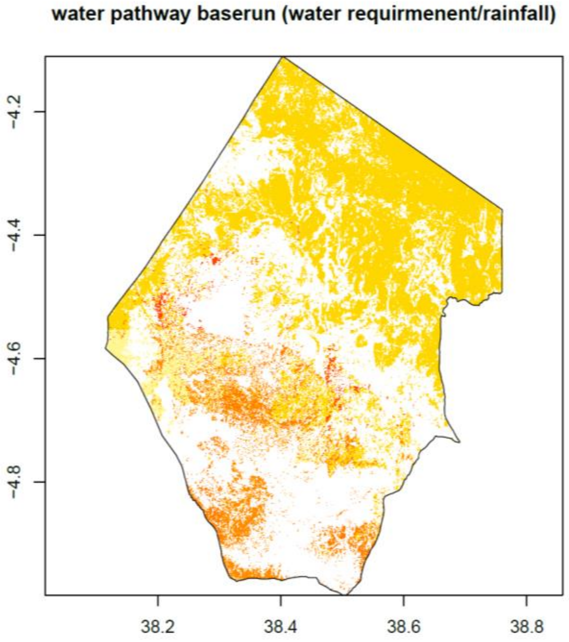

Mixed crop-livestock
Soil-Indirect N2O 2%
Burning...
Soil-Direct N2O 6%
Manure-Direct N2O 4%
Manure-Indirect N2O 3%
Manure-Methane 5%
Enteric fermentation-Methane 71%


% change in GHG per milk produced
% change of kg CO2-eq kg FPCM-1 compared to baseline
20
10
0
-10
-20
-30
-40
-50
Improved breeds
Improved feeding
Increased animal health
Agropastoralist
Mixed crop-livestock

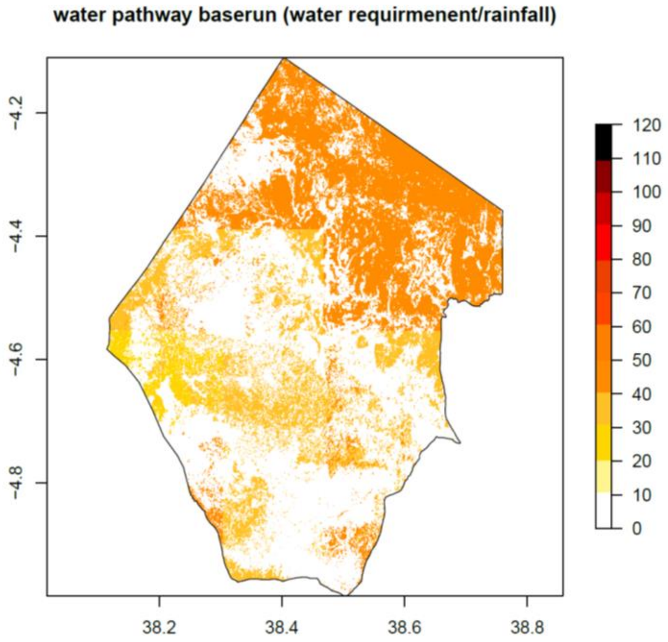

N balance per area
kg N ha-1
100
80
60
40
20
0
-20
-40
-60
baseline
Improved breeds
Improved feeding
Increased animal health



Baseline



Feed scenario

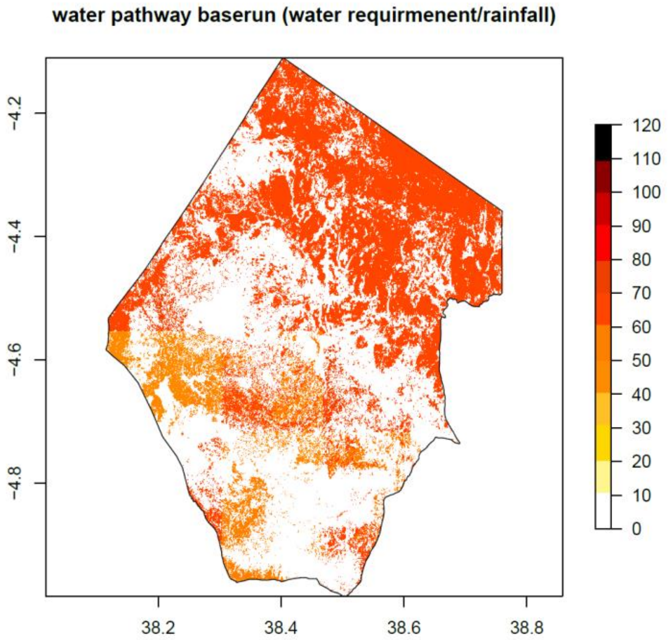


Genetics scenario

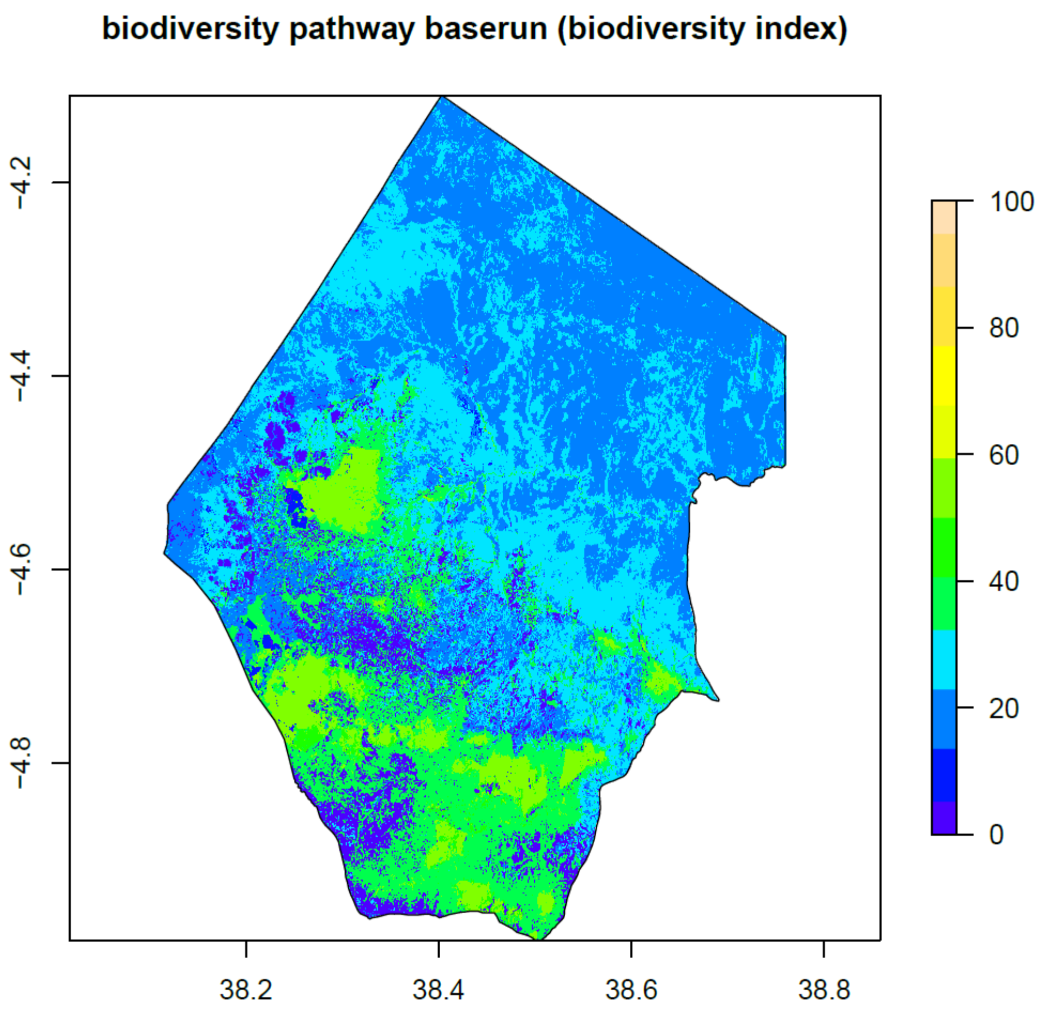
Water use

- Indicated by: crop water use as percentage of rainfall

- Water use driven by milk yield and liveweight – but then by feed types and their yield – so shifting to planted fodder more efficient than natural grazing



Animal health scenario



Biodiversity

- Indicated by: biodiversity index – percent of IUCN red list species in the area using the location as habitat

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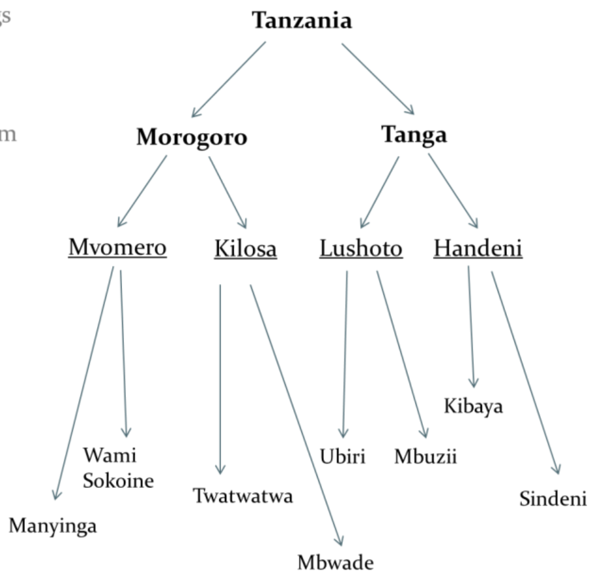
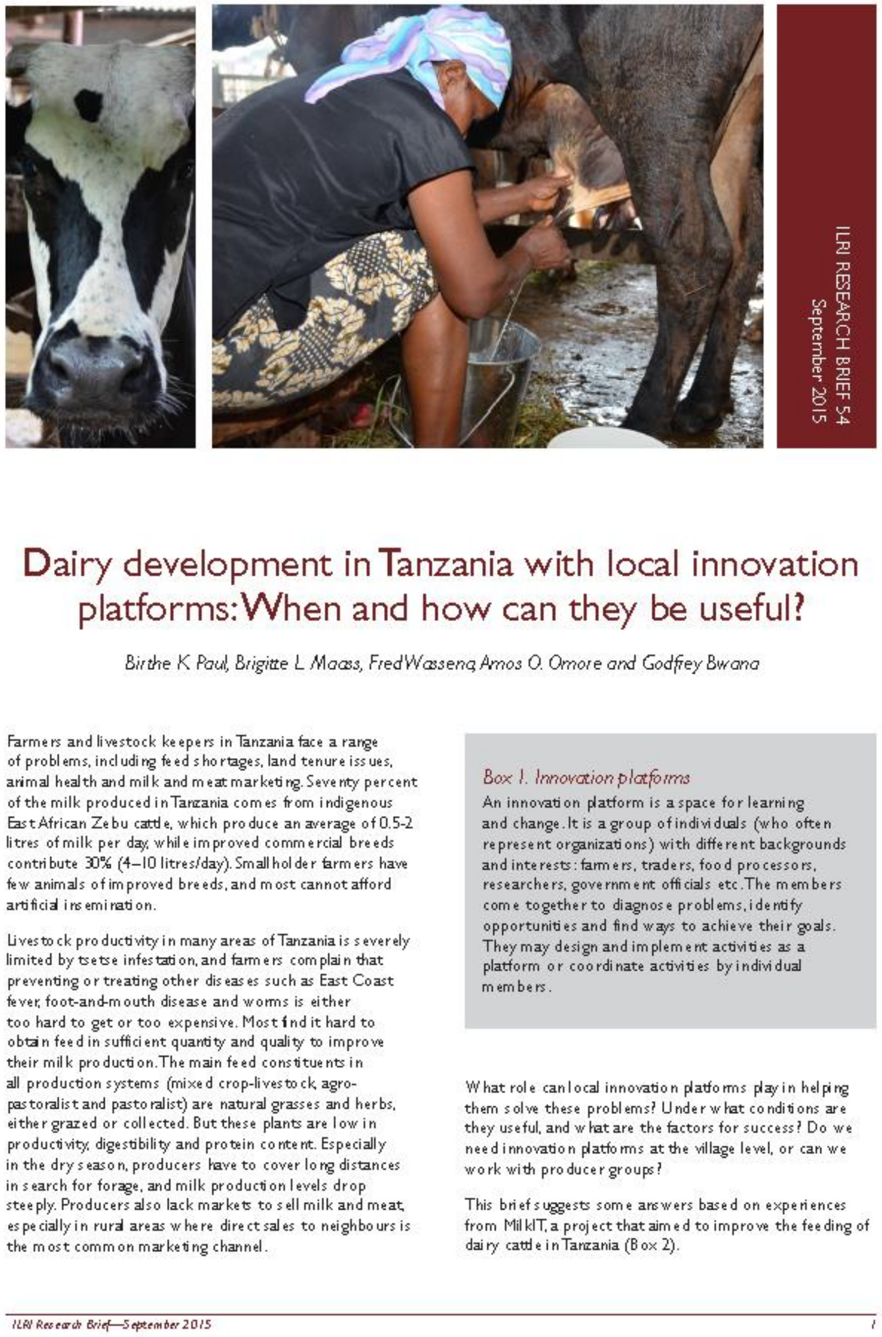
Picture: Neil Palmer, CIAT

Village innovation platforms in Lushoto

- Country level meetings (Dairy Development Forum)
- Regional dairy platform meetings
- District policy making
- Village Innovation Platforms





ILRI RESEARCH BRIEF 54
September 2015

Dairy development in Tanzania with local innovation platforms: When and how can they be useful?

Birthe K Paul, Brigitte L Maass, Fred Wassena, Amos O. Omore and Godfrey Bwana

Farmers and livestock keepers in Tanzania face a range of problems, including feed shortages, land tenure issues, animal health and milk and meat marketing. Seventy percent of the milk produced in Tanzania comes from indigenous East African Zebu cattle, which produce an average of 0.5-2 litres of milk per day, while improved commercial breeds contribute 30% (4–10 litres/day). Smallholder farmers have few animals of improved breeds, and most cannot afford artificial insemination.

Livestock productivity in many areas of Tanzania is severely limited by tsetse infestation, and farmers complain that preventing or treating other diseases such as East Coast fever, foot-and-mouth disease and worms is either too hard to get or too expensive. Most find it hard to obtain feed in sufficient quantity and quality to improve their milk production. The main feed constituents in all production systems (mixed crop-livestock, agro-pastoralist and pastoralist) are natural grasses and herbs, either grazed or collected. But these plants are low in productivity, digestibility and protein content. Especially in the dry season, producers have to cover long distances in search for forage, and milk production levels drop steeply. Producers also lack markets to sell milk and meat, especially in rural areas where direct sales to neighbours is the most common marketing channel.

Box 1. Innovation platforms

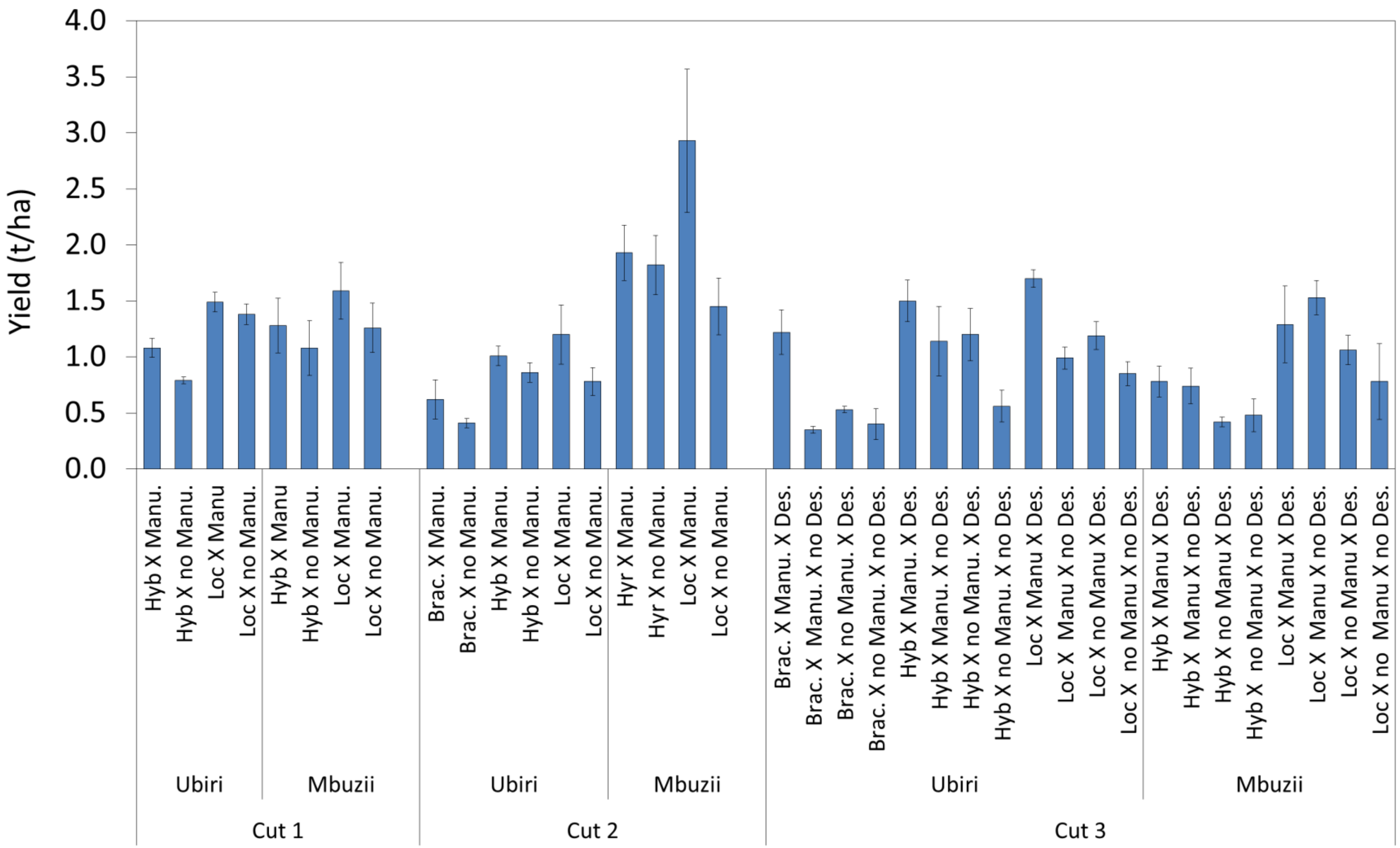
An innovation platform is a space for learning and change. It is a group of individuals (who often represent organizations) with different backgrounds and interests: farmers, traders, food processors, researchers, government officials etc. The members come together to diagnose problems, identify opportunities and find ways to achieve their goals. They may design and implement activities as a platform or coordinate activities by individual members.

What role can local innovation platforms play in helping them solve these problems? Under what conditions are they useful, and what are the factors for success? Do we need innovation platforms at the village level, or can we work with producer groups?

This brief suggests some answers based on experiences from MilkIT, a project that aimed to improve the feeding of dairy cattle in Tanzania (Box 2).

ILRI Research Brief—September 2015 1

Randomized forage trials



Soil quality

Ubiri, Lushoto

	Bray P mg/kg	Total Nitrogen %	Total Carbon %	Soil organic matter (g/kg)	Recommendations
samples	4.53	0.20	1.74	30.02	1. Addition of P fertilizers: Very low levels indicate acute deficiency & most crops will respond to P fertilizers. 2. Monitoring soil N levels and applying recommended rates of N fertilizer; levels that are too high may leach into ground water causing contamination. 3. Continuing with organic matter application to maintain soil organic matter levels
	5.81	0.27	2.66	45.81	
	7.35	0.28	2.88	49.67	
	2.46	0.21	1.87	32.22	
	2.18	0.21	2.11	36.43	
	1.63	0.19	1.85	31.90	
	2.74	0.23	2.13	36.74	
	1.36	0.21	2.00	34.50	
	6.24	0.28	2.77	47.83	
AVERAGE	**2.70**	**0.17**	**1.56**	**25.65**	

Mbuzii, Lushoto

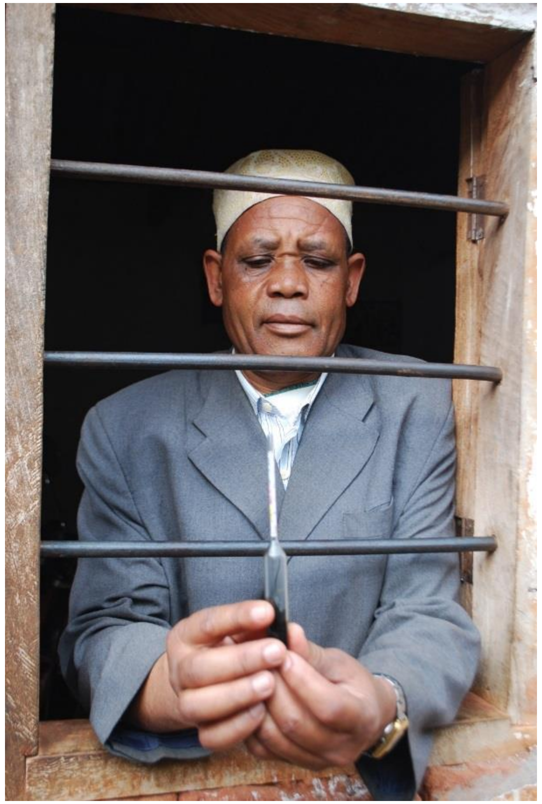
	Bray P mg/kg	Total Nitrogen %	Total Carbon %	Soil organic matter (g/kg)	Recommendations
samples	8.34	0.34	3.68	63.40	1. Addition of P fertilizers: Very low levels indicate acute deficiency & most crops will respond to P fertilizers. 2. Monitoring soil N levels and applying recommended rates of N fertilizer; levels that are too high may leach into ground water causing contamination. 3. Continuing with organic matter application to maintain soil organic matter levels
	3.01	0.23	2.22	38.28	
	3.28	0.30	3.03	52.29	
	3.66	0.30	3.02	52.14	
	2.17	0.26	2.57	44.31	
	1.38	0.15	1.45	24.93	
	1.32	0.13	1.04	17.88	
	1.07	0.14	1.33	22.86	
	1.11	0.14	1.25	21.60	
AVERAGE	**2.45**	**0.20**	**1.94**	**33.44**	

Forage experimentation

- Local Napier produced higher biomass than the hybrid, with a clearly higher biomass where manure was applied. Hybrid Napier produced more tillers.
- Biomass was generally higher where Napier was intercropped with Desmodium
- Bachiaria under either manure or Desmodium intercrop did not out-yield either of the Napier provenance
- In conclusion, intercropping with Desmodium with either of the grasses increases the dry matter yield per unit area which, especially under manuring. Therefore, smallholder dairy farmers should preferably grow Napier when intercropped with Desmodium for increased forage productivity.

Farmer forage experimentation

Site	Forages	Women (no.)	Men (no.)	Total (no.)	Forages received from TALIRI
Ubiri	Received in 2014	11	14	25	Napier hybrid, Napier Kakamega II, Greenleaf desmodium, Mulberry and Gliricidia sepium
	End of 2015	38	49	87	
Mbuzii	Received in 2014	9	19	28	Napier hybrid, Napier Kakamega II, Greenleaf desmodium, Mulberry Canavalia brasiliensis (only in demo plot)
	End of 2015	9	19	28	



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Picture: Neil Palmer, CIAT

Conclusions

- Enteric fermentation is the largest contributor to GHG emissions
- Emission intensities are higher for mixed crop-livestock systems when measured per area, but lower per liter milk produced
- N balances are negative for mixed farming, and positive for agro-pastoralists due to the manure produced by the relatively big herd
- Livestock intensification strategies result in almost all cases in lower emission intensities, especially in the agro-pastoral system
- Improved livestock feeding through planted forages is a promising option, both for productivity (especially under intercropping and manure) and environment
- Further work is done to assess farm and landscape scale tradeoffs between productivity and environmental impacts

Partners

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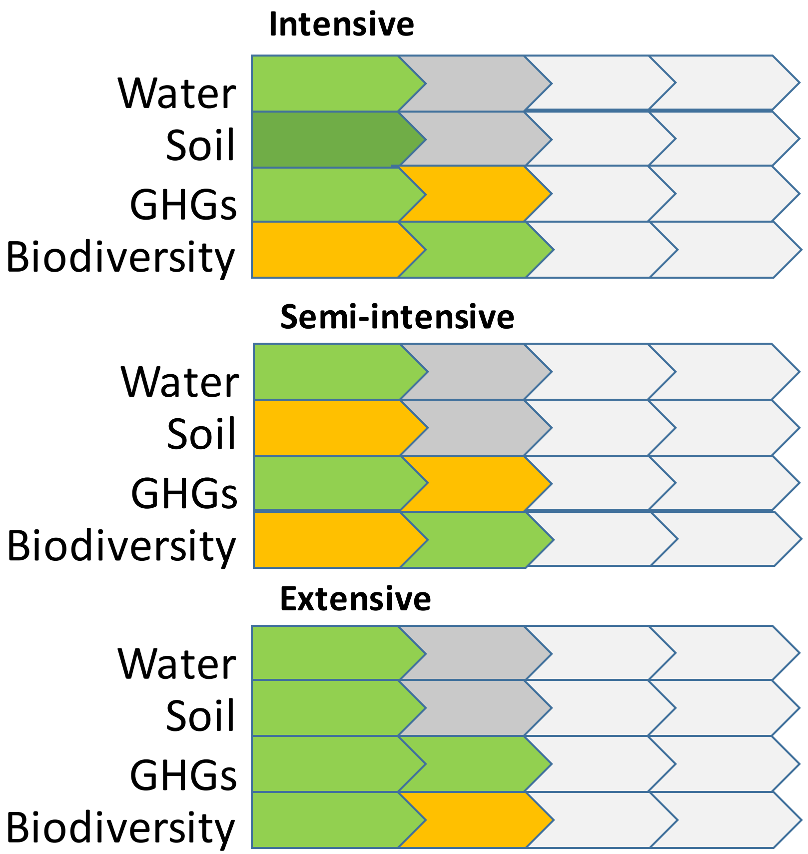
Science for a food secure future



* VC step partly assessed
** VC step not yet assessed