

Mazingira Centre: environmental and education facility in East Africa

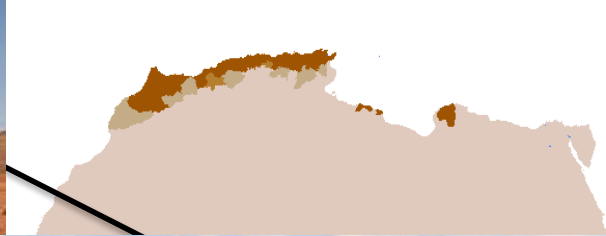
Lutz Merbold, John P Goopy, David E Pelster, Klaus Butterbach-Bahl and the Mazingira Team
International Livestock Research Center (ILRI), Nairobi, Kenya



Africa

a continent challenged by global environmental change

Desertification and
overgrazing



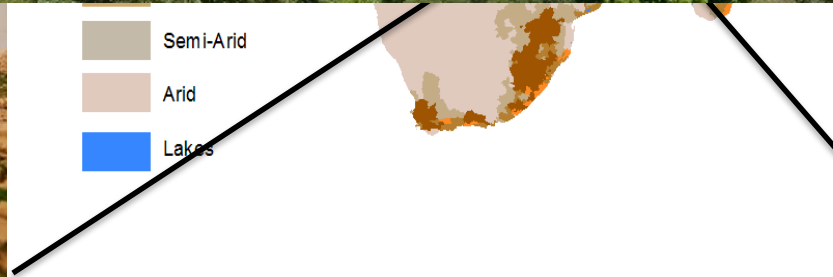
Multiple environmental stresses hindering economic development and
jeopardizing livelihoods



Climate change and
extreme events



Semi-Arid
Arid
Lakes

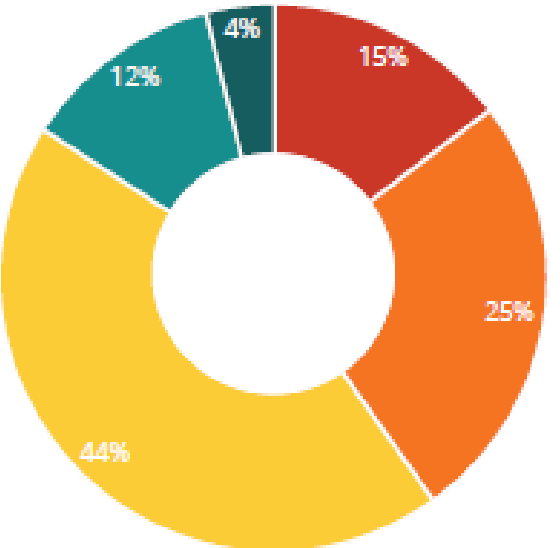


Deforestation



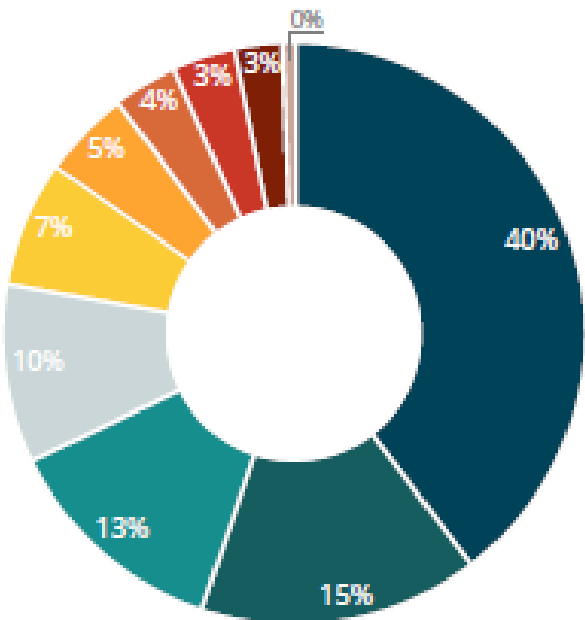
AFOLU and GHG emissions

%-contribution of continents to total AFOLU GHG emissions



- Africa
- Asia
- Americas
- Europe
- Oceania

GHG-emissions by sector

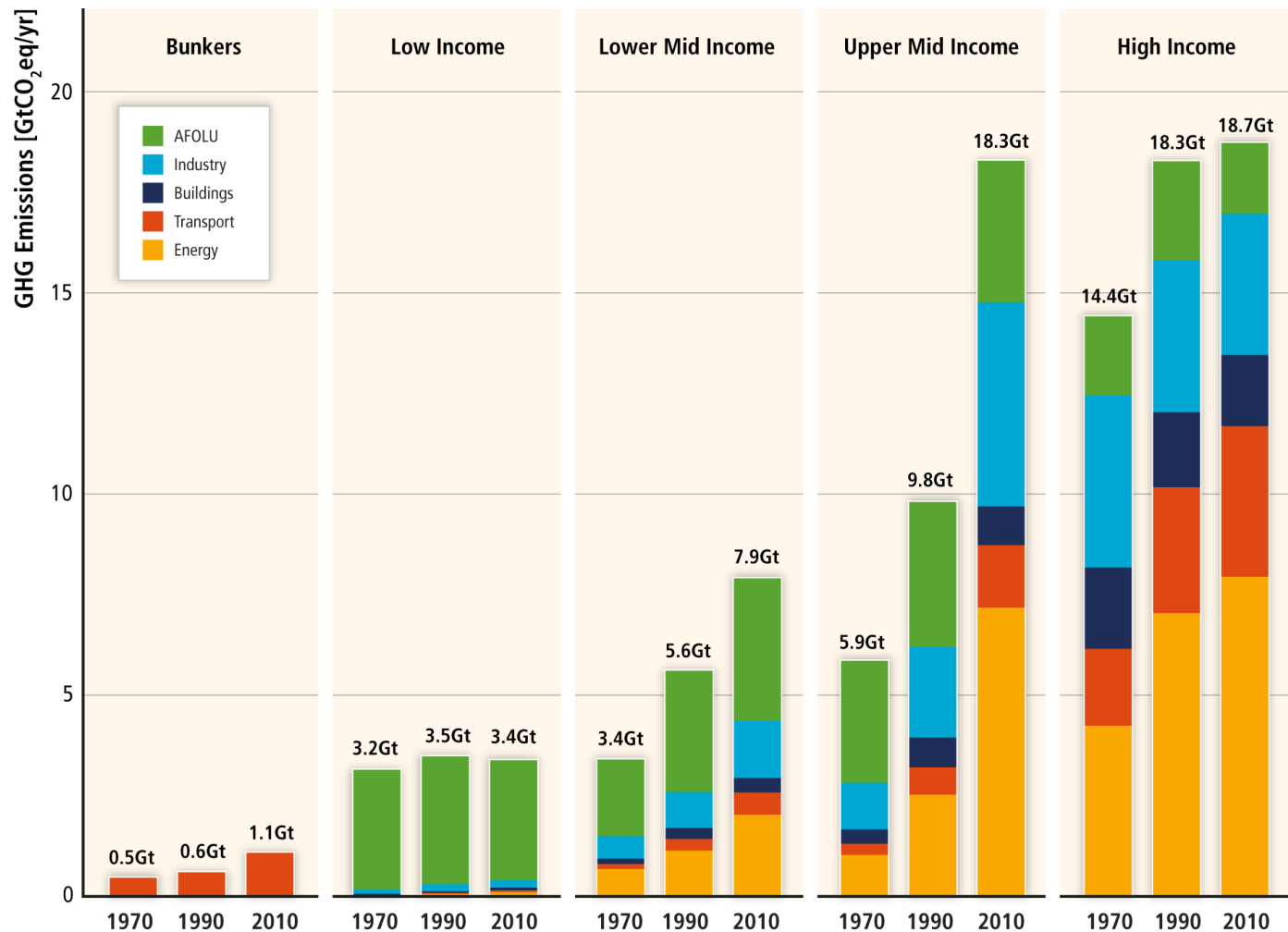


- Enteric fermentation
- Manure left on pasture
- Manure management
- Manure applied to soils
- Burning - savanna
- Synthetic fertilizer
- Rice cultivation
- Crop residues
- Cultivation org. soils
- Burning – crop res.

Approx. 70% of emissions related to livestock production

FAO, Tubiello et al. 2014

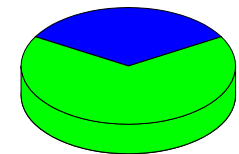
Importance of Agriculture to GHG emissions



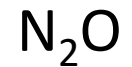
Worldwide Emissions



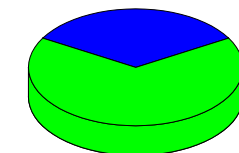
Industrial sources



Livestock, rice paddies, wetlands



Industrial sources



Agriculture, forests, oceans

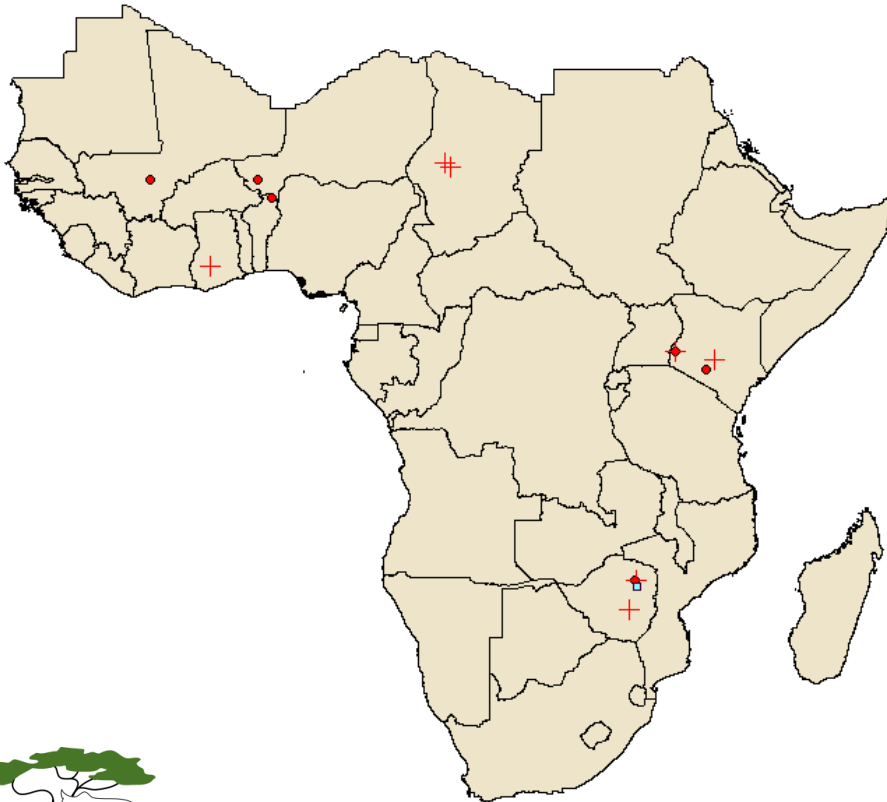
Livestock GHG emissions, why do we even care?

- Agriculture: 30% of anthropogenic GHG emissions in SSA.
- Livestock: > 70% of agricultural GHG emissions.
- So What? So why do the poorest farmers in the world care about their animals' GHG emissions?
- They Don't!
- But they care about their animals and their livelihoods -> KEY

Why do we need empirical studies?

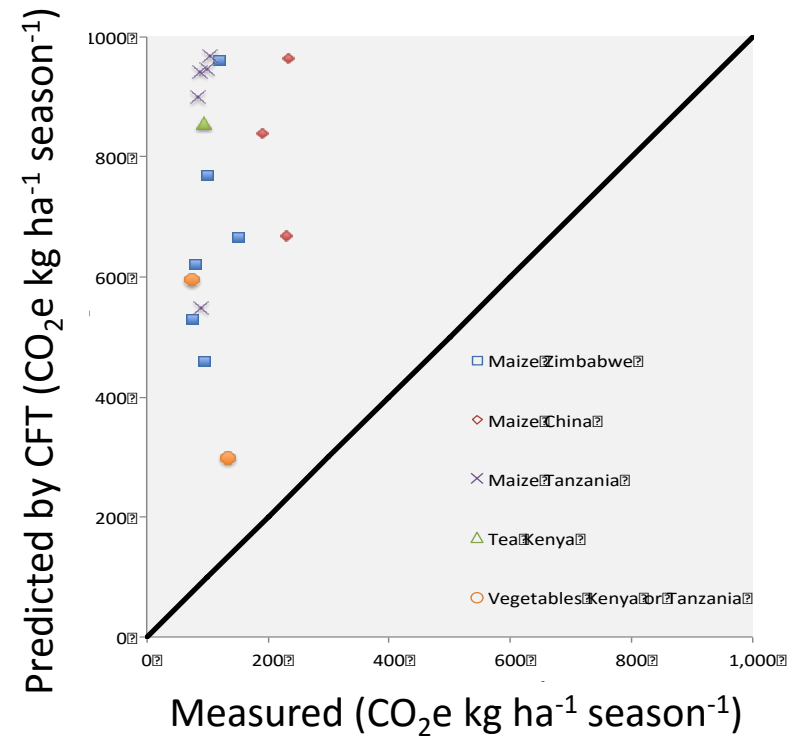
Why are the emission factors incorrect?

- limited dataset
 - models use emission factors from other regions
 - other regions have different climate / soils / management / animal breeds, etc.



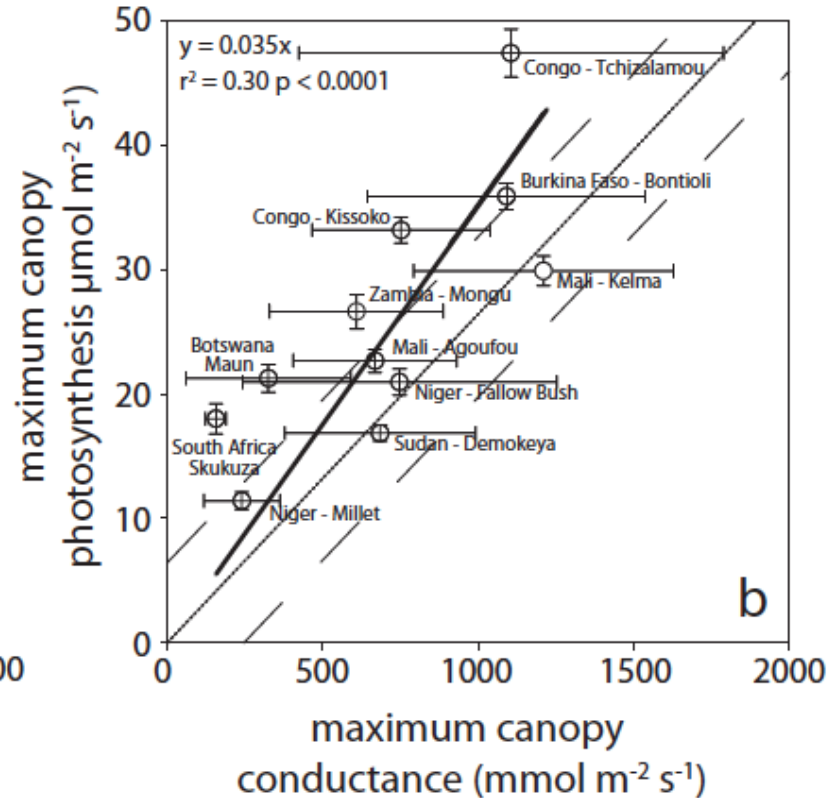
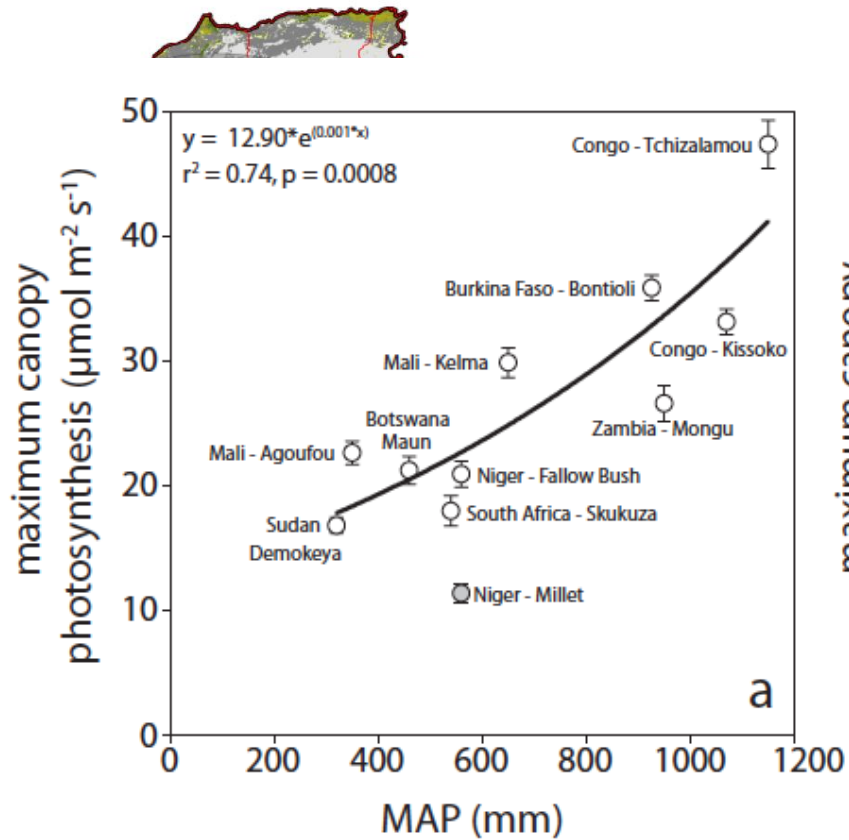
Hickman et al. 2014

Prediction error for smallholder cropping systems



Richards et al. in prep

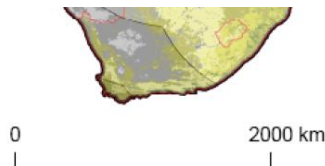
GHG fluxes in Africa



1-11 Sites in this study (see Table 1)

+ Other CARBOAFRICA sites

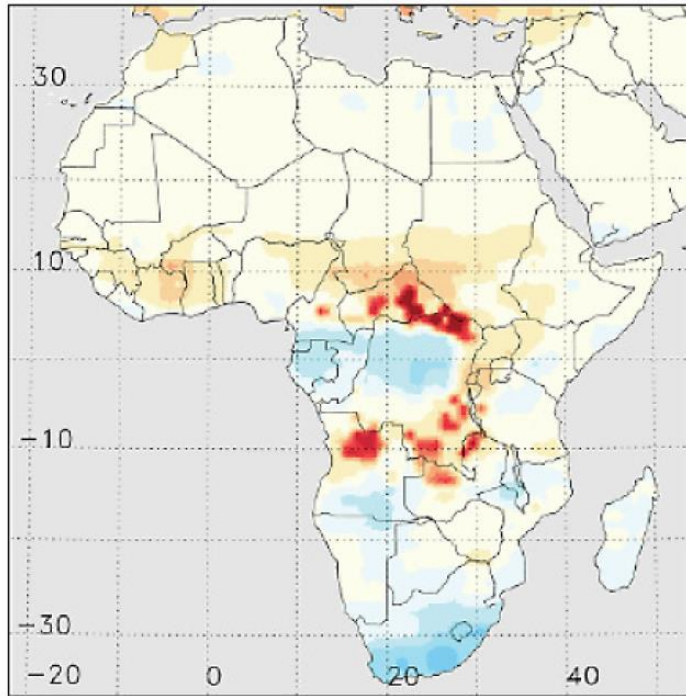
Distance to closest site in this study (1000, 1500 & 2000 km)



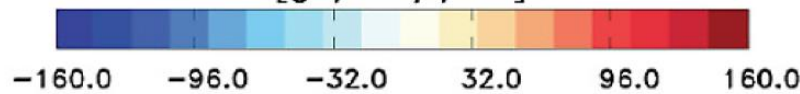
GHG fluxes in Africa

Natural CO₂ fluxes (2001-2004 mean)

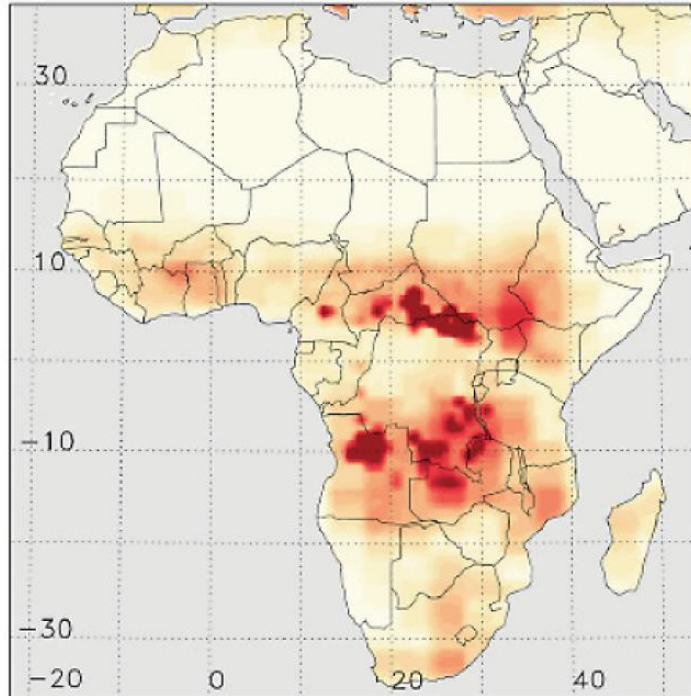
Mean across all inversions



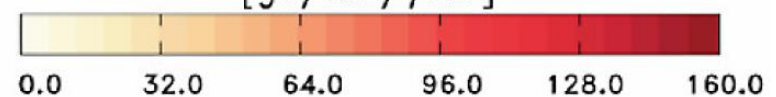
[gC/m²/year]



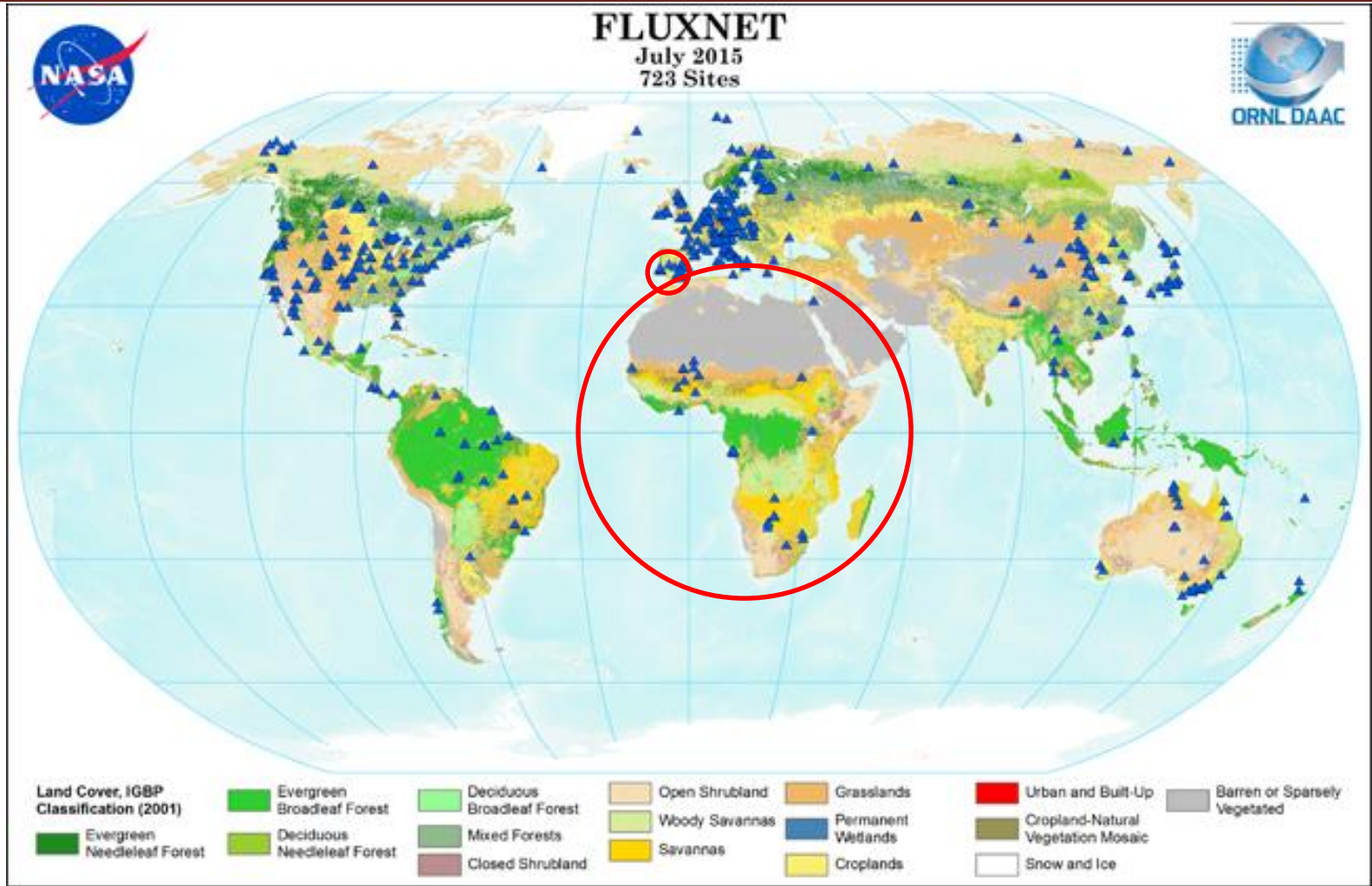
Standard deviation across all inversions



[gC/m²/year]



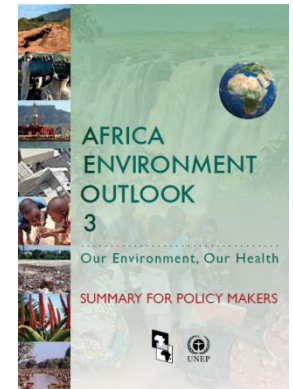
Global GHG observations (flux towers)



African continent is the least developed with largest demographic changes predicted until 2050

Why an Environmental Research Centre for East Africa?

- East Africa
 - Economic growth
 - High population density and growth
 - Biodiversity hotspots
 - Rapid environmental degradation and environmental changes
 - Hub for many international organizations
 - Commitment of Ethiopian, Kenyan and Ugandan Ministries of Environment and agriculture for joined work on emission factors and inventoring
- Poor capacity to target, monitor, analyze, address and manage environmental problems
 - Identifying hot spots
 - Derive a baseline and monitoring the state of the environment
 - Identifying the drivers of environmental change
 - Identify appropriate, cost effective methods
 - Integrate knowledge

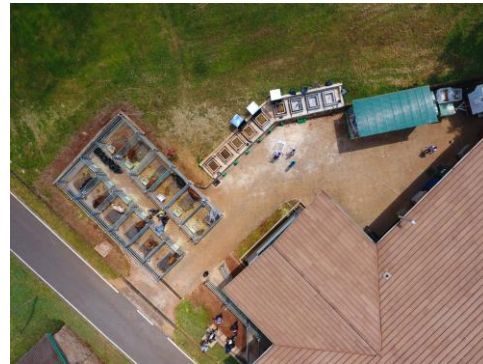


UNEP 2013, Africa Environment Outlook

”
“Making promising policies work”

Mazingira Centre (Nairobi, Kenya)

(fully operational since summer 2015, strongly supported by KIT, Germany)



analytical capacity

- C/N analyzer, sampling gear, nutrition analysis
- Livestock respiration chambers
3 x small, 3 x large, 1 x mobile + Picarro
- Eddy covariance system
(NH_3 , N_2O , CO_2 , CH_4), Aerodyne QCLAS
- Automatic chambers
9 x chambers + Picarro
- Manual chambers and GC lab
7 x GC (N_2O , CH_4 , CO_2 , (SF_6))
- Manure/soil/plant analysis
- Nutritional lab (crude protein, fiber)
- Water analysis
 NH_4^+ , NO_3^- , DOC/DON, water balan.
- Meteorological stations

Mazingira Centre activities

(fully operational since summer 2015, strongly supported by KIT, Germany)

Vision:

- to test and develop management strategies that increases livestock, feed and crop production, while decreasing GHG emissions and environmental degradation



Mazingira Centre activities

(fully operational since summer 2015, strongly supported by KIT, Germany)



Vision:

- to provide crucial environmental baseline data for East Africa
- to serve as center for capacity building for environmental observations and assessments
- hub for scientific exchange in Kenya



What do the preliminary data look like?

From livestock manure:

- N_2O
 - IPCC estimates: 2% of grazing cattle manure N
 - Preliminary data => between 10 and 40% of IPCC
- CH_4
 - Between 4 and 14% of IPCC emission factors

From cropping systems:

- N_2O
 - IPCC estimates: 1% of applied N
 - Preliminary data => between 0.01 and 0.1% (Hickman et al. 2015); or
 - Low fertilizer application rates resulted in no noticeable increase in N_2O emissions (GBC Rosenstock et al. 2016; BGD Pelster et al. 2016, JEQ Pelster et al. 2016)



Why is this important?

- National inventories for IPCC calculated using (most likely) incorrect data (TIER 1 approach),
- Nationally Appropriate Mitigation Actions (NAMA) depend on correct understanding of current emissions and projected effects of the mitigation actions,
- Intended Nationally Determined Contribution (INDCs) can only be tackled with profound understanding of the systems ,
- Currently we have no accurate estimates of either of these,
- Environmental in-situ data for African continent remains scarce
-> bias not-only in earth system models

Questions?



Partial Mazingira team in June 2016

Shade Akinesete, Paul Mutuo, George Wanyama, Asaah Ndambi, Daniel Korir, Hillary Rotich, Steven Okoth, David Pelster, Yuhao Zhu, Andrew Mbithi, Lutz Merbold

not shown:

Jesse Owino, Jesse Kagai, Victoria Carbonell, John Goopy, Asep Ali, Shimels Wassi, Showman Gwatibaya, Klaus Butterbach-Bahl, Phyllis Ndungu, Alice Anyongo, Suzanne Jacobs



Mazingira
Centre

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RESEARCH PROGRAM ON
Climate Change,
Agriculture and
Food Security



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