Importance of developing regional greenhouse gas emission factors

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CGIAR Research Program on Climate Change, Agriculture and Food Security — CCAFS

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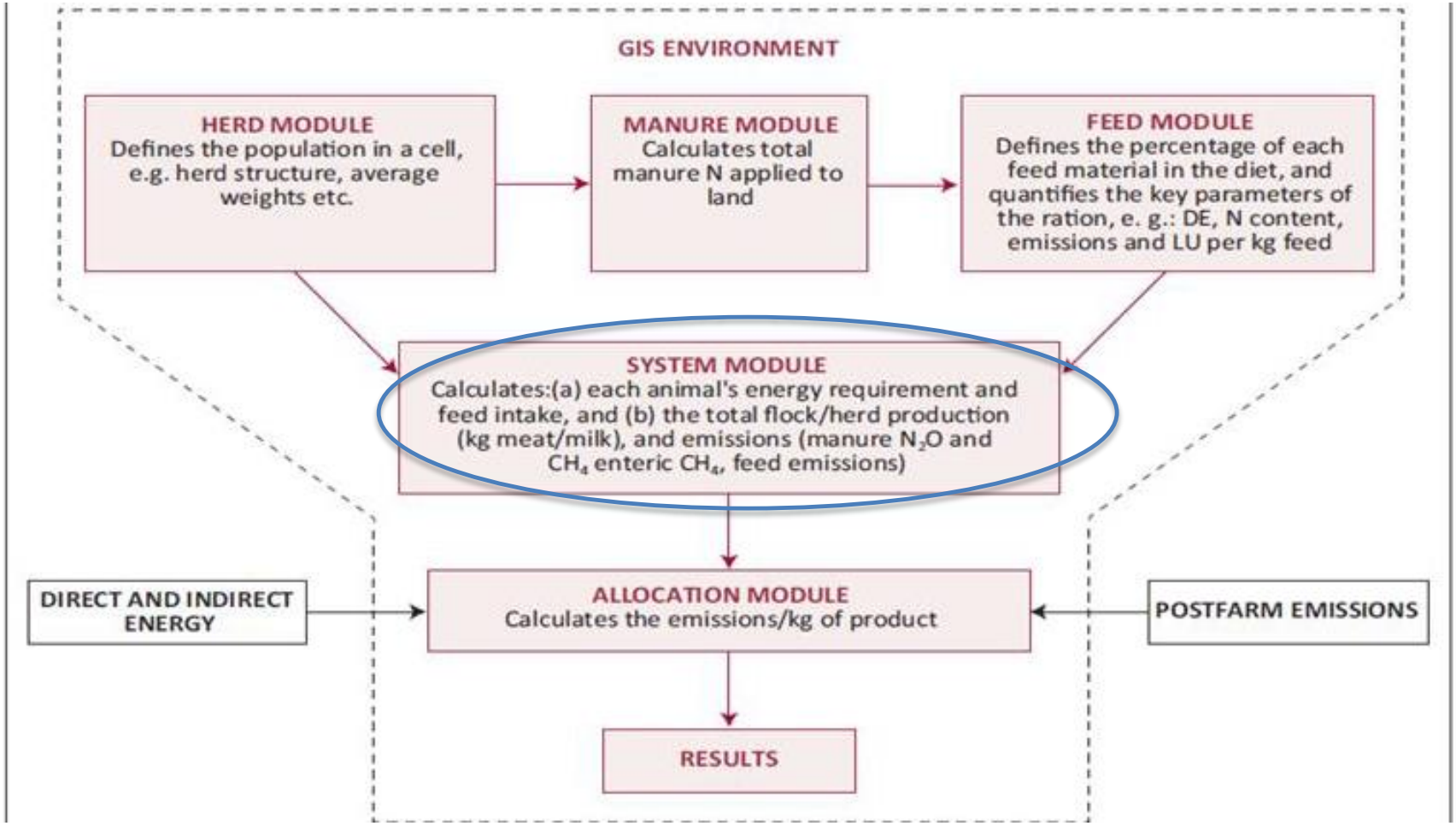
How do we calculate the emissions?



From FAO. Global Livestock Environmental Accounting Model (GLEAM)

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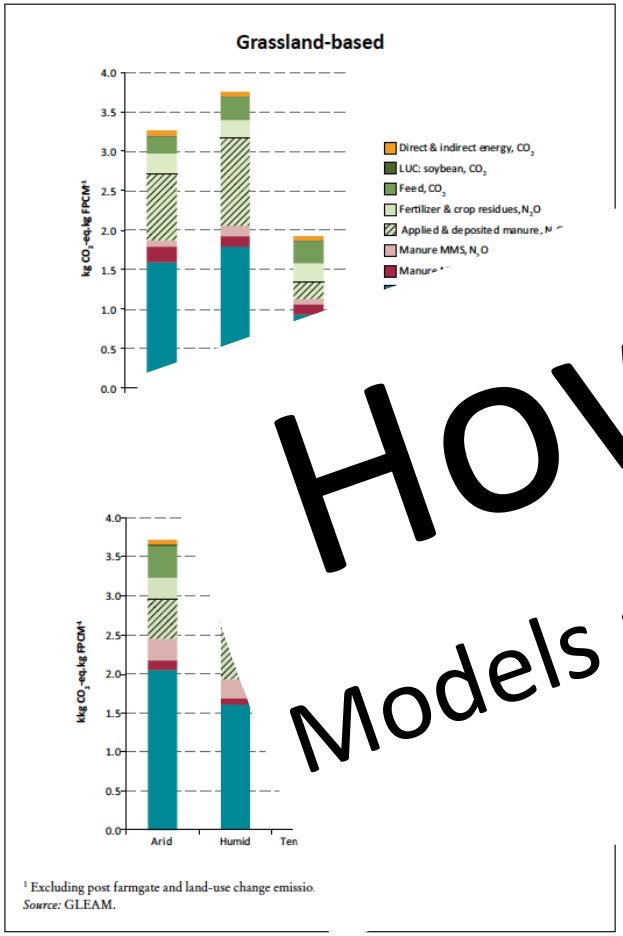
How do we calculate the emissions?



However!!!!

Models are only as good as their data

From Opio et al. 2013. Greenhouse gas emissions from ruminant supply chains

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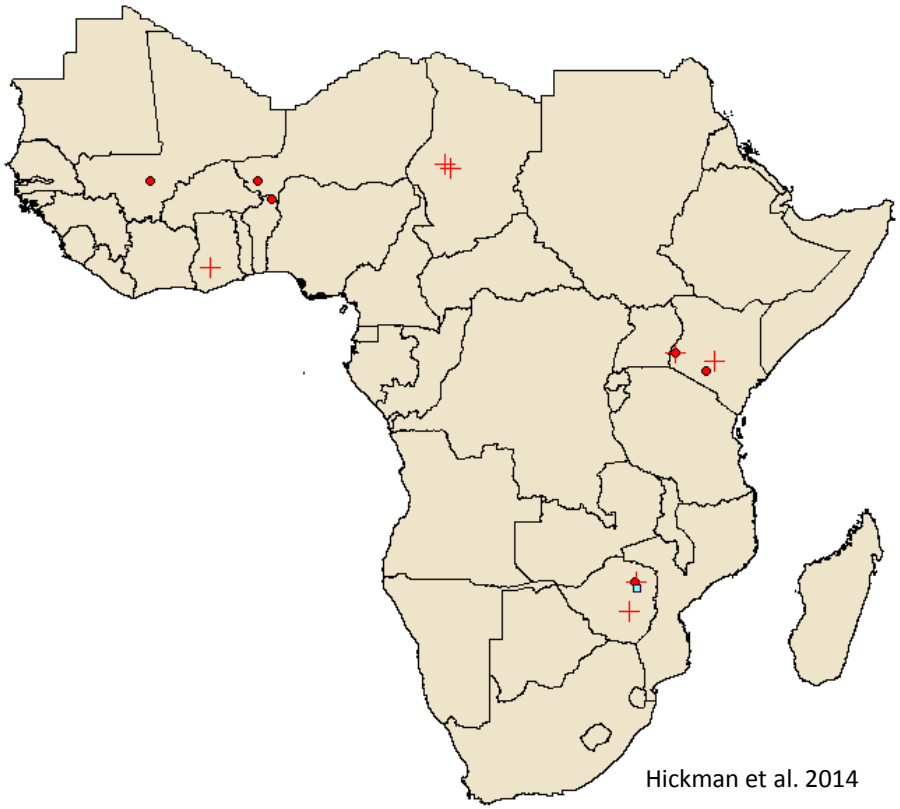
Why we need empirical studies

Models likely using incorrect emission factors

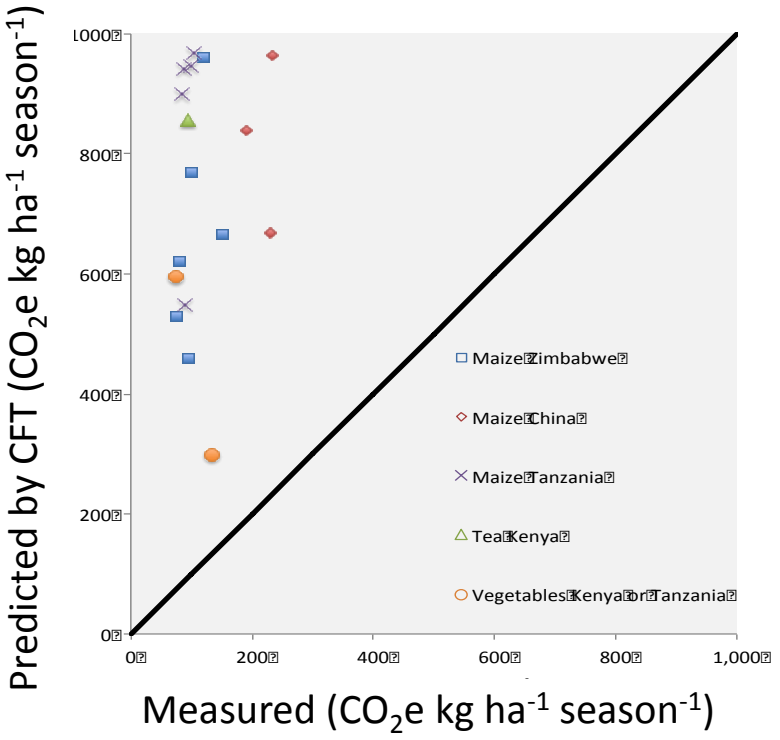
Why are the emission factors incorrect?

- Limited dataset
  - Models use emission factors from other regions
  - These 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

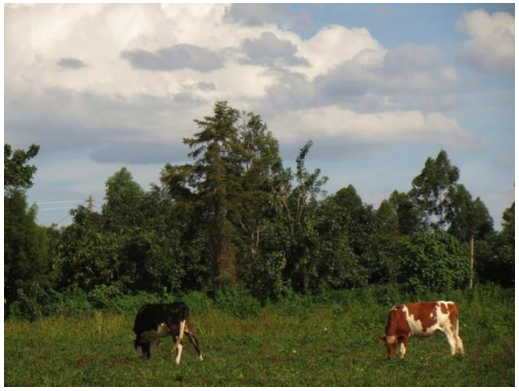
What do the preliminary data look like?

From livestock manure on rangelands:

- N_2O
  - IPCC estimates: 2% of grazing cattle manure N
  - Preliminary data => between 10 and 40% of IPCC (EF from 0.2 to 0.8%)
- CH_4
  - Between 9 and 25% of IPCC emission factors Pelster et al. 2016

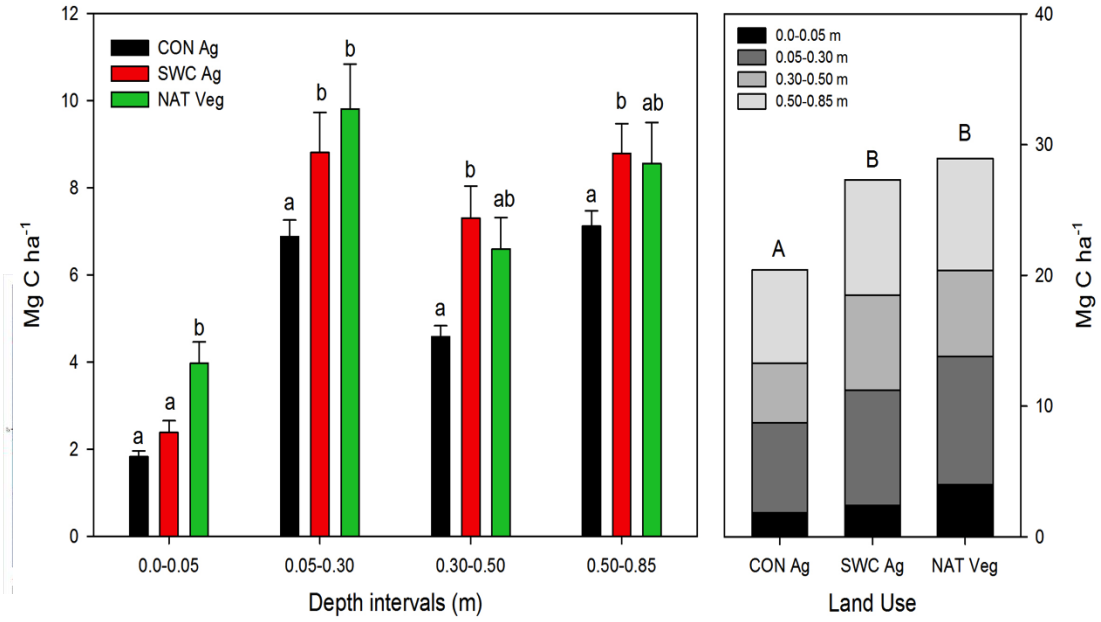
From cropping systems:

- N_2O
  - IPCC estimates: 1% of applied N
  - Preliminary data => between 1 and 10% of IPCC estimates (0.01 and 0.1% of applied N) (Hickman et al. 2015); or
  - Low fertilizer application rates resulted in no noticeable increase in N_2O emissions (Rosenstock et al. 2016; Pelster et al. 2016)
  - An on-going study in sugar cane has similar results



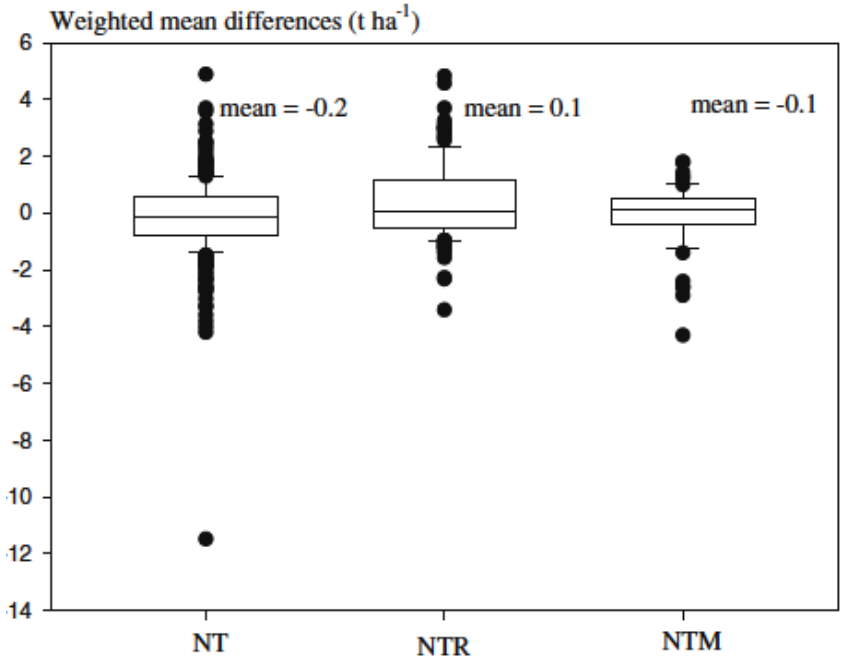
Why is this important?

- National inventories for IPCC
- Nationally Appropriate Mitigation Actions (NAMA)
  - LEDs
  - Financing
  - Verification. i.e. Is “climate smart agriculture” really climate smart?

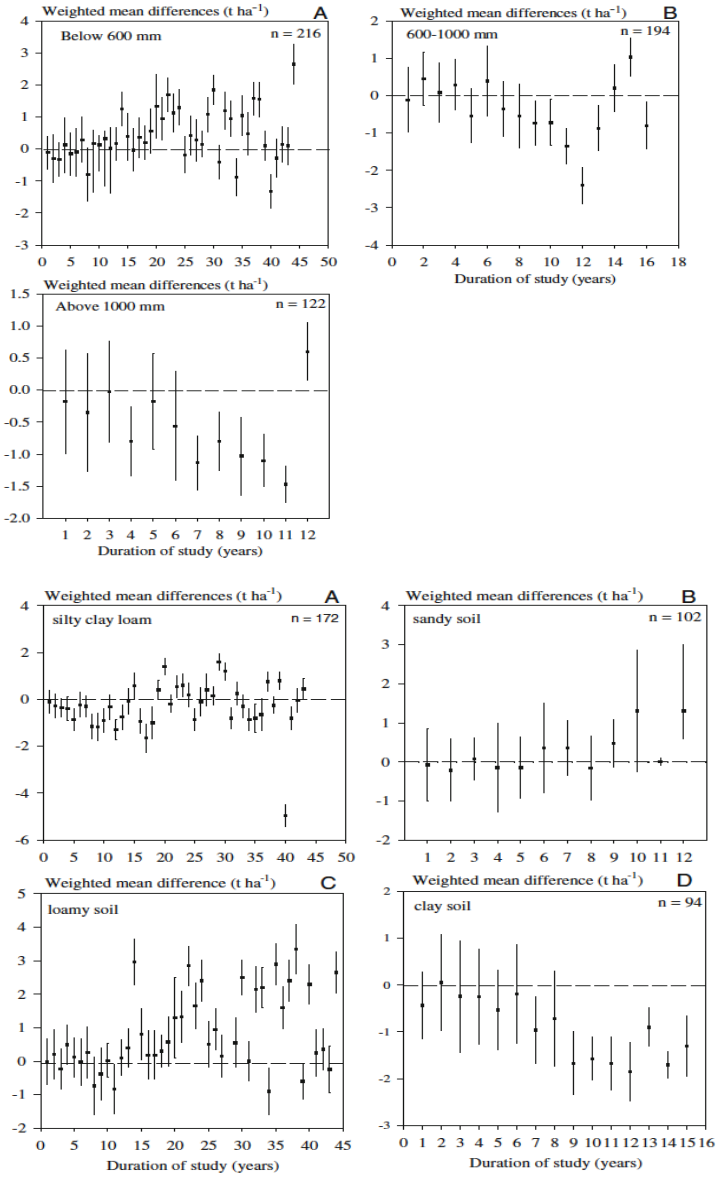


“Climate Smart Agriculture”

- No-till (or conservation tillage) is often promoted as a “climate smart practice”
- There are current projects that promote no-till to improve maize yields and sequester carbon

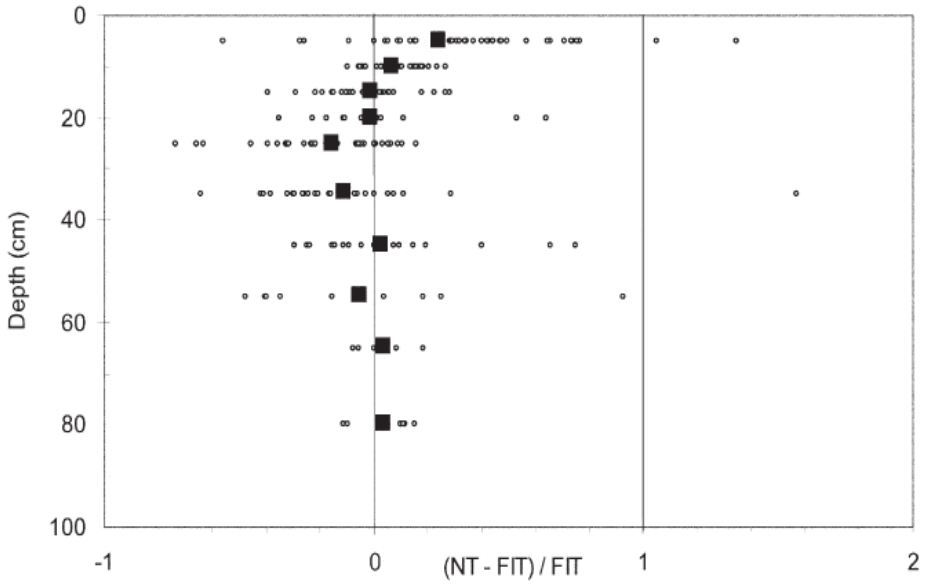


Rusinamhodzi et al. 2011. Agronomy Sust. Developm.



“Climate Smart Agriculture”

- No-till (or conservation tillage) is often promoted as a “climate smart practice”
- There are current projects that promote no-till to improve maize yields and sequester carbon
- But…. Do they truly mitigate climate change?
- Need to understand and account for the local conditions



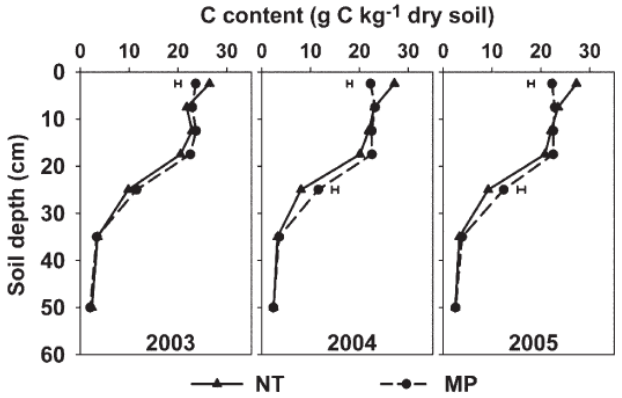
Angers and Eriksen-Hamel 2008. SSSAJ

Table VIII. Greenhouse gas balance for no-tillage.

Greenhouse gas flux	GWP[a]	CO_2-equivalents
325 ± 113 kg C·ha^{-1}·yr^{-1}	1	1192 ± 414
–2.91 ± 0.78 kg N_2O-N·ha^{-1}·yr^{-1}	310	–1418 ± 382
0.42 ± 0.10 kg CH4-C·ha^{-1}·yr^{-1}	21	11.8 ± 2.8
	Balance	–214

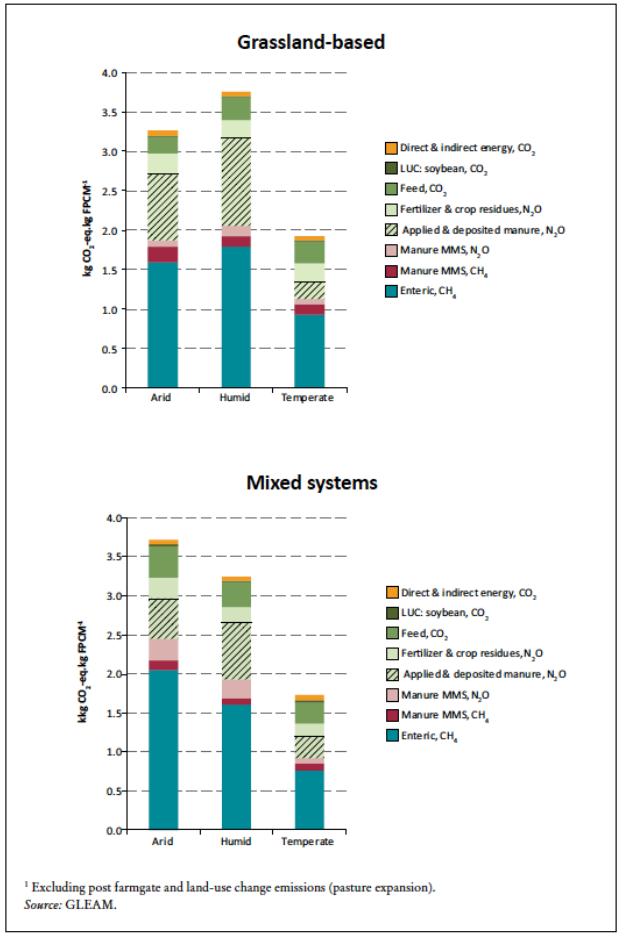
[a] GWP = Global warming potential [149].

Six et al. 2002. Agronomie

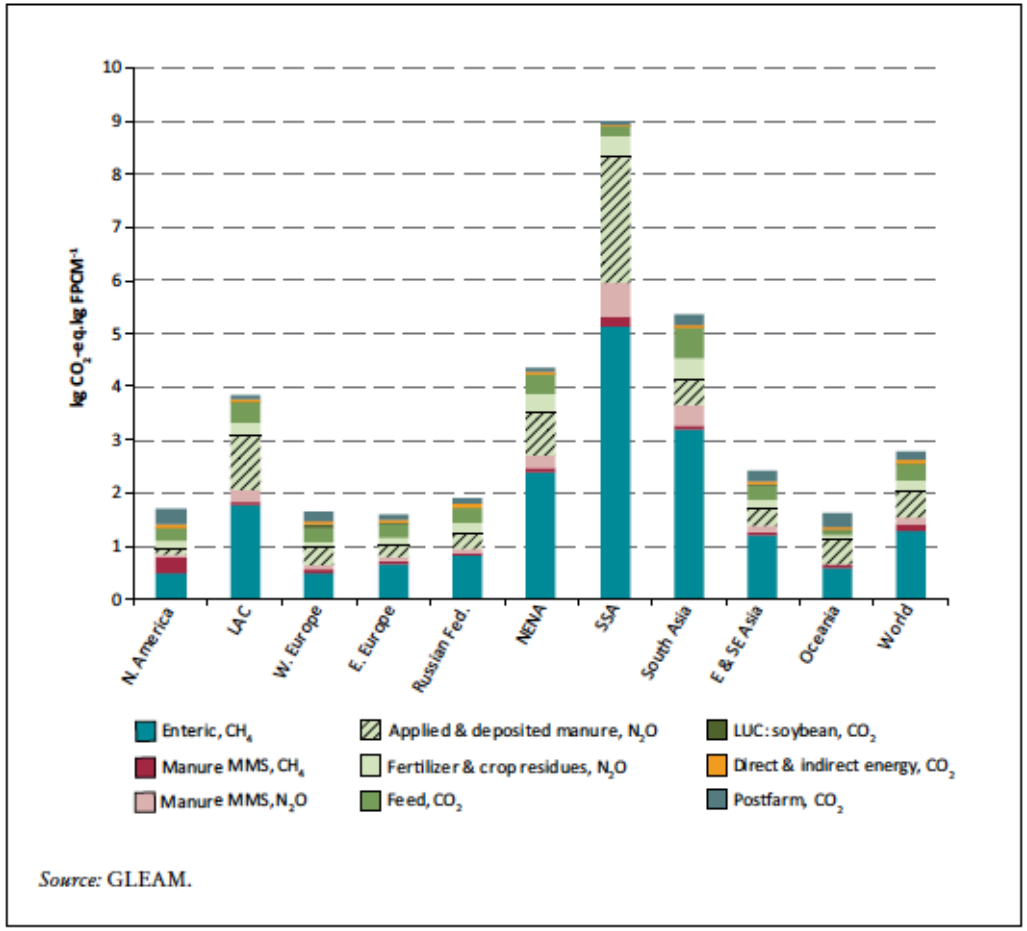


Poirier et al. 2009. SSSAJ

Targeting development strategies to reduce emissions?



[1] Excluding post farmgate and land-use change emissions (pasture expansion).
Source: GLEAM.



Source: GLEAM.

From Opio et al. 2013. Greenhouse gas emissions from ruminant supply chains

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