Sources of statistics and activity data for Sub-Saharan Africa livestock GHG inventories What is out there that we could use?

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Background

- Need good quality data for deriving good emission factors for livestock
- There is a need for disaggregation of emission factors by system to design better mitigation options
- Several regional/global and local datasets that could be useful for this

What data do we need to do this?

- Knowledge of:
  1. the prevailing production systems and their spatial distribution
  2. the numbers of livestock in each production system
  3. Feeding systems: what animals consume throughout the year (and its quality)
  4. The relationships between what animals consume, produce and excrete
  5. Manure management systems
  6. How systems and livestock populations will change in time (intensification climate change and others) as a result of increases in demand for livestock products

Classifying livestock systems

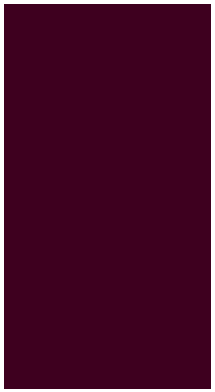
- Simple but robust system types
- Agro-ecological conditions
- Management
- Different productive characteristics

- Standardisation and comparison

A Global Livestock Classification System

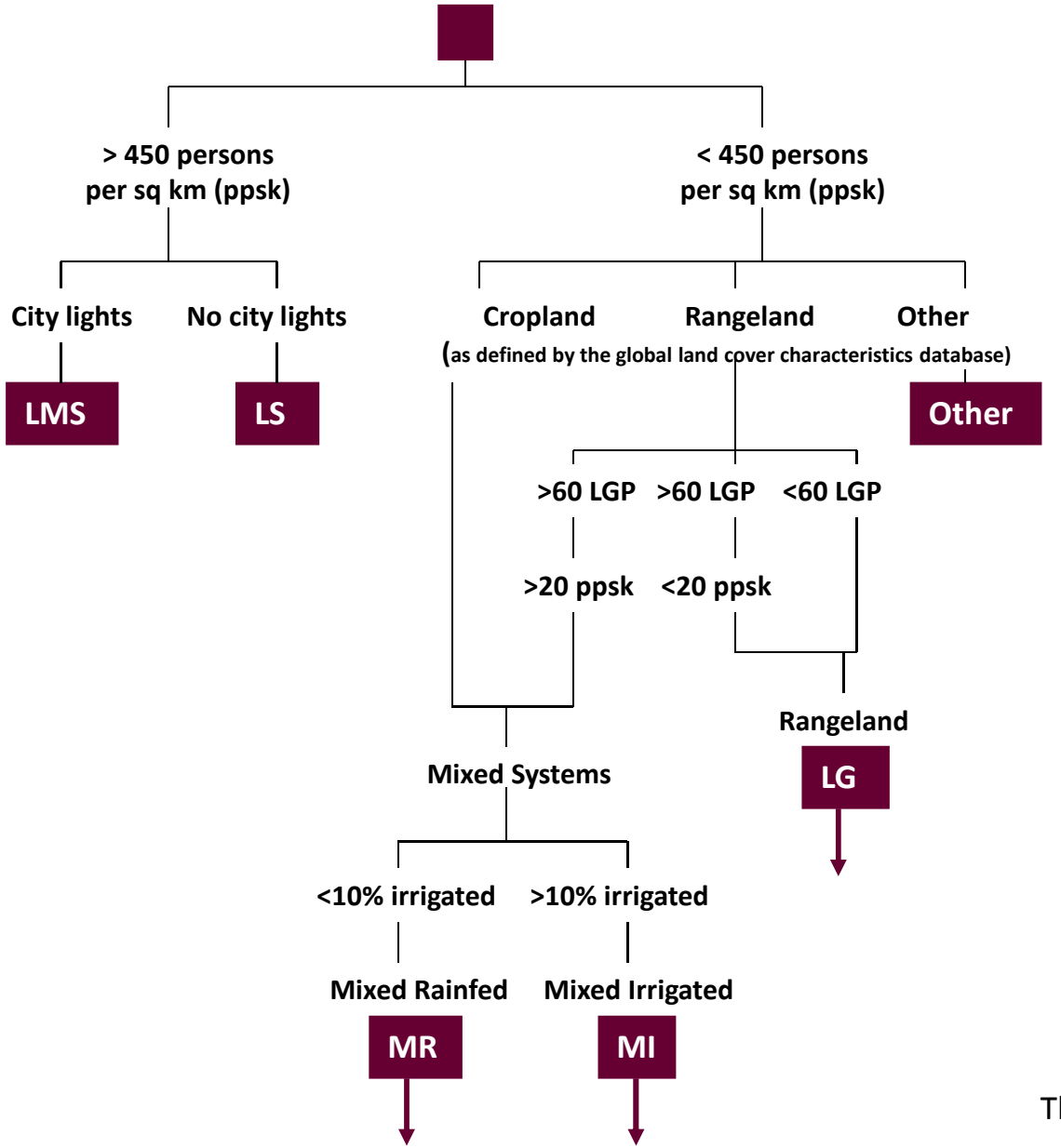
Seré and Steinfeld (1996)

Grassland-based systems (LG)	Tropical highland/temperate (T)	LGT
	Humid-subhumid (H)	LGH
	Arid-semiarid (A)	LGA
Mixed systems (M)		
Irrigated (I)	Tropical highland/temperate (T)	MIT
	Humid-subhumid (H)	MIH
	Arid-semiarid (A)	MIA
Rainfed (R)	Tropical highland/temperate (T)	MRT
	Humid-subhumid (H)	MRH
	Arid-semiarid (A)	MRA
Landless (LL)	Monogastrics (M)	LLM
	Ruminants (R)	LLR



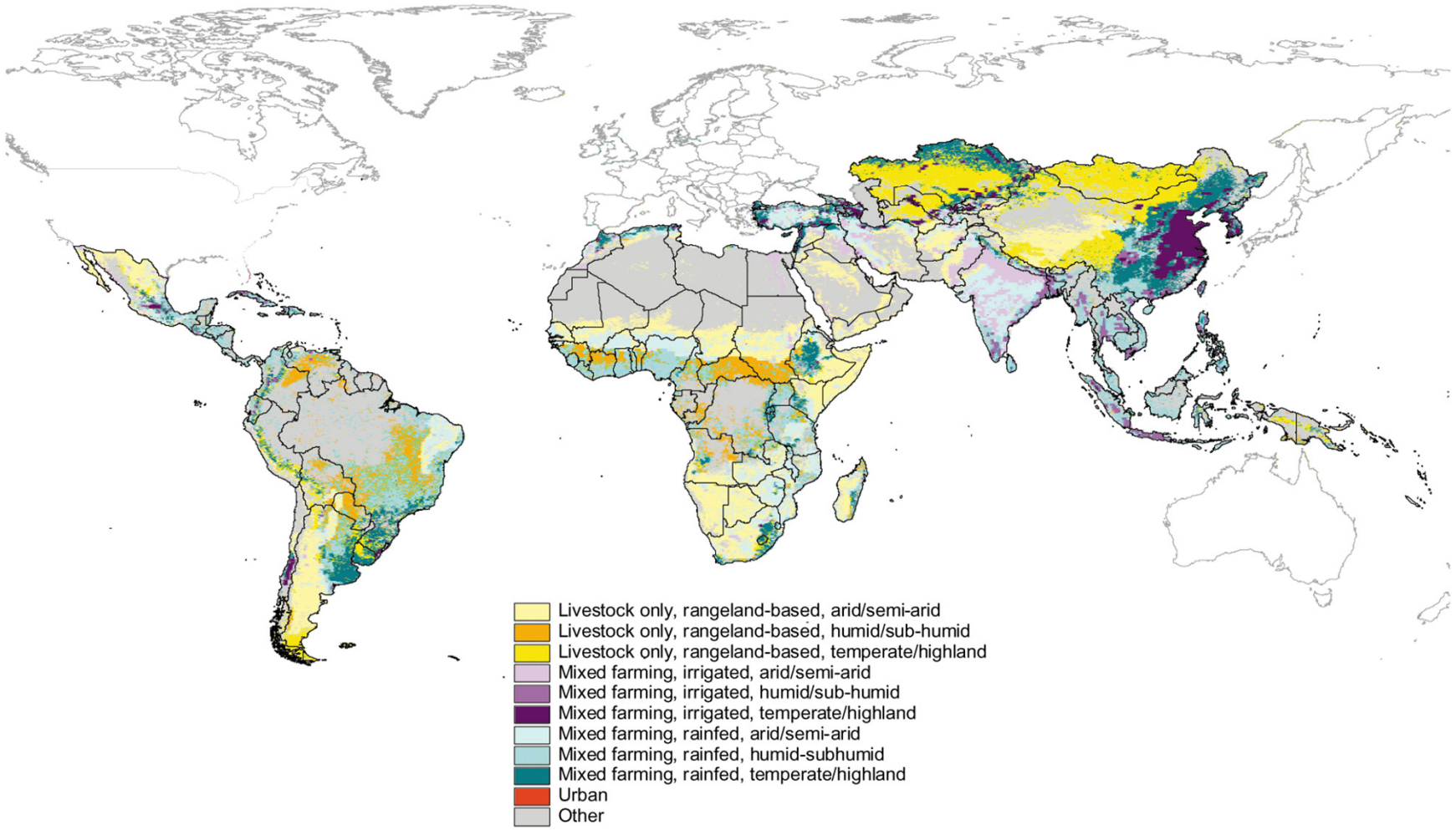
Thornton et al 2002

1 Decision tree for mapping the classification



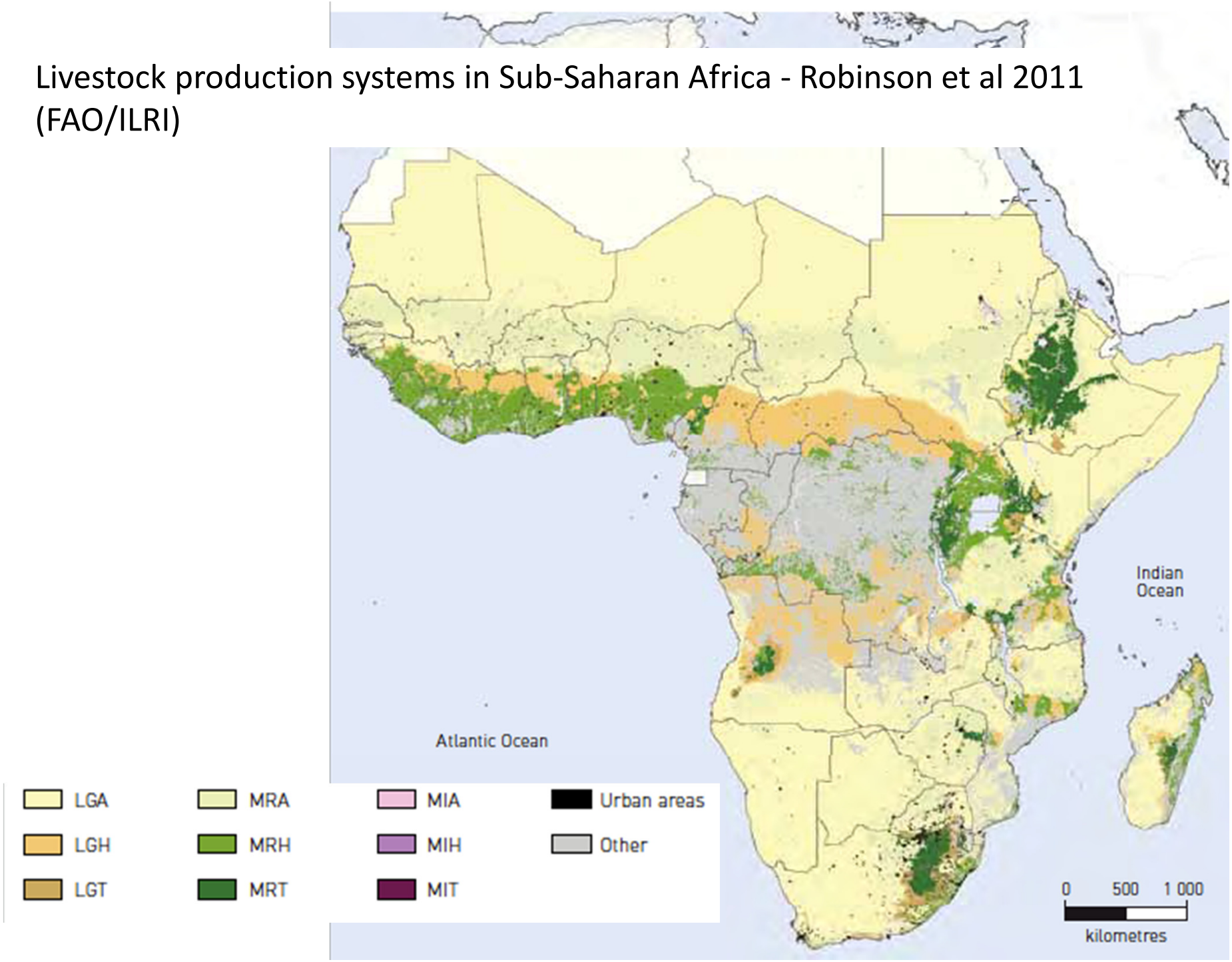
Thornton et al 2002

Map 3. Global Livestock Production Systems

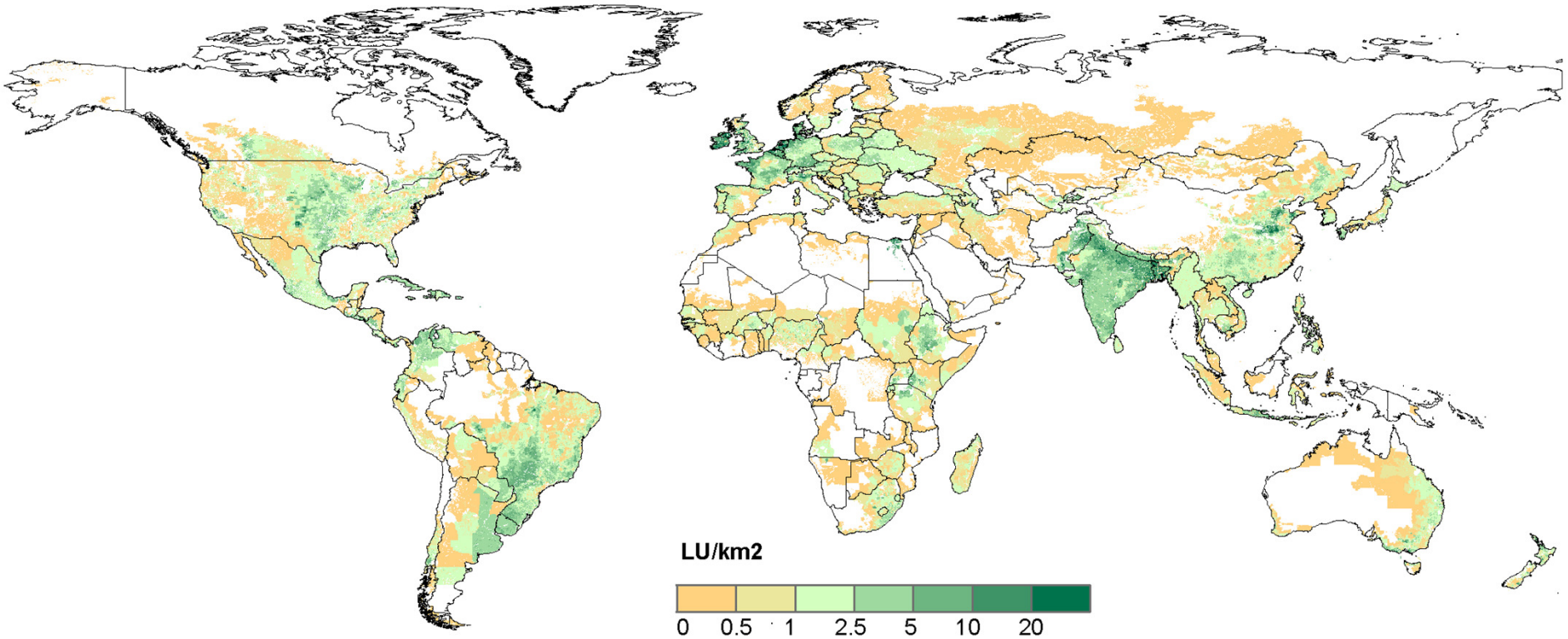


Thornton et al 2002

Livestock production systems in Sub-Saharan Africa - Robinson et al 2011 (FAO/ILRI)



Bovine density – 2000
Gridded livestock of the world (FAO)



Cattle, sheep, goats, buffalos, pigs, poultry
No split between dairy and meat
Poor spatial allocation of monogastrics

Crop distribution layers: Spatial production allocation model

- 20 global crops
- Developed by IFPRI
- Spatial resolution of 18 km
- Useful for calculating stover amounts and grain production as feeds
- Necessary to supplement this information with local knowledge on how animals are fed

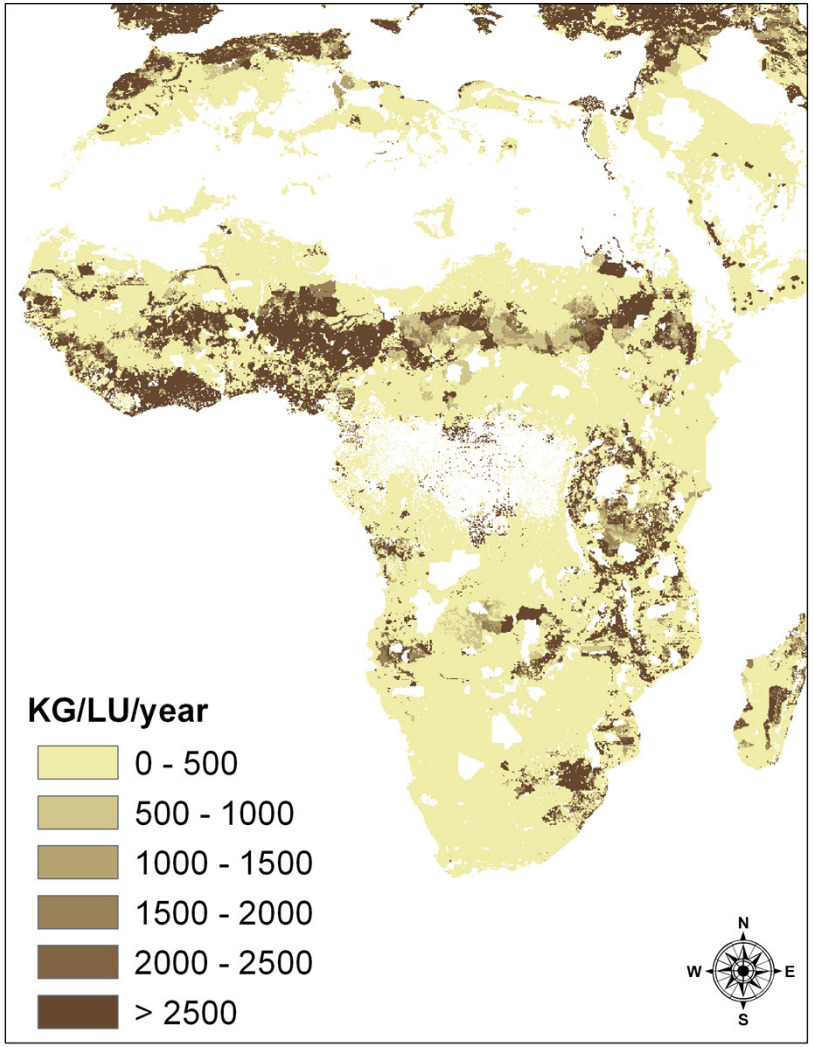
- GEOshare layers (Ramankutty et al…)

Stover production

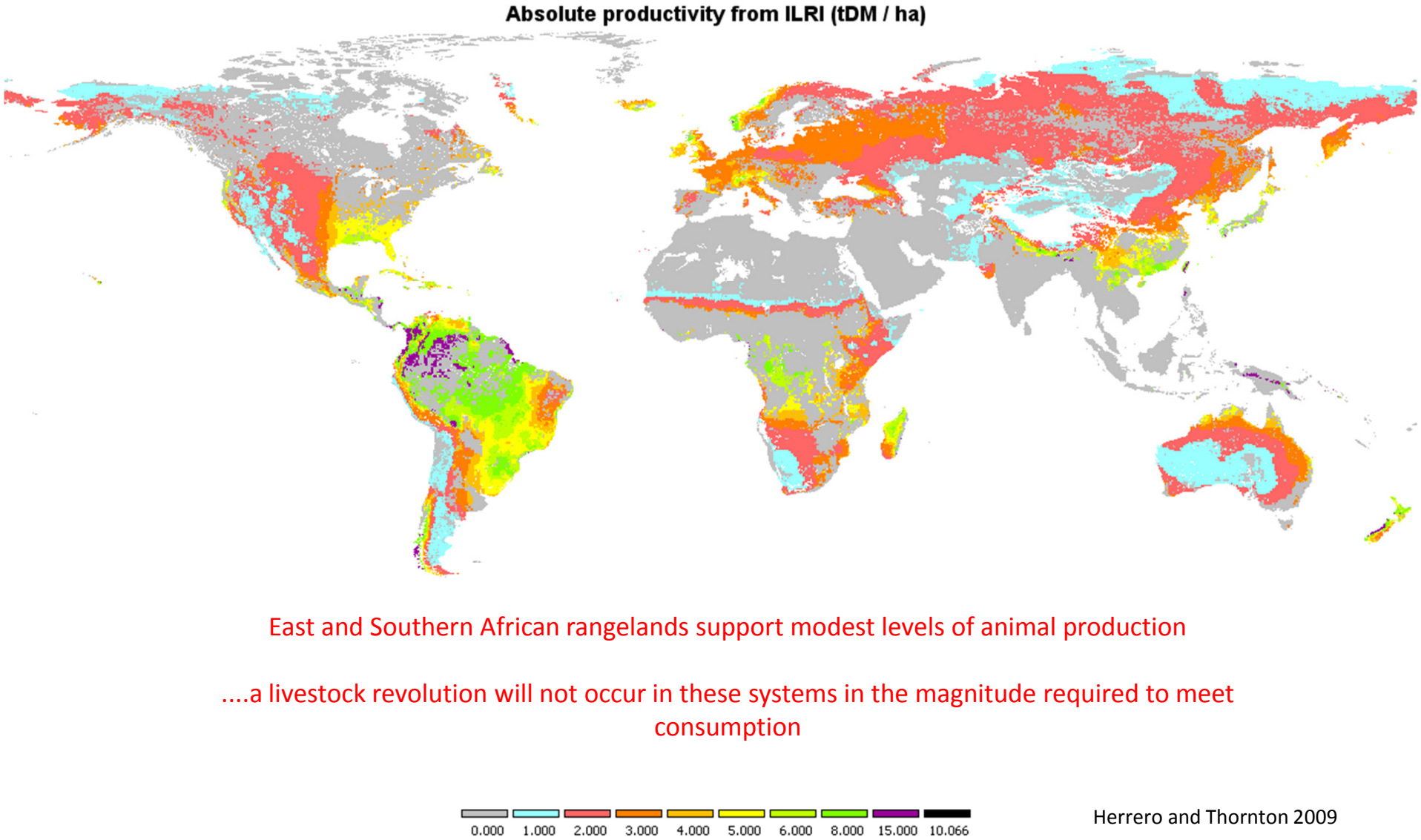
It is about crop residues:

-Only feed growing in quantity
-Not competing for the use of land

...but how to use it better
...it is of poor quality



Global rangeland productivity

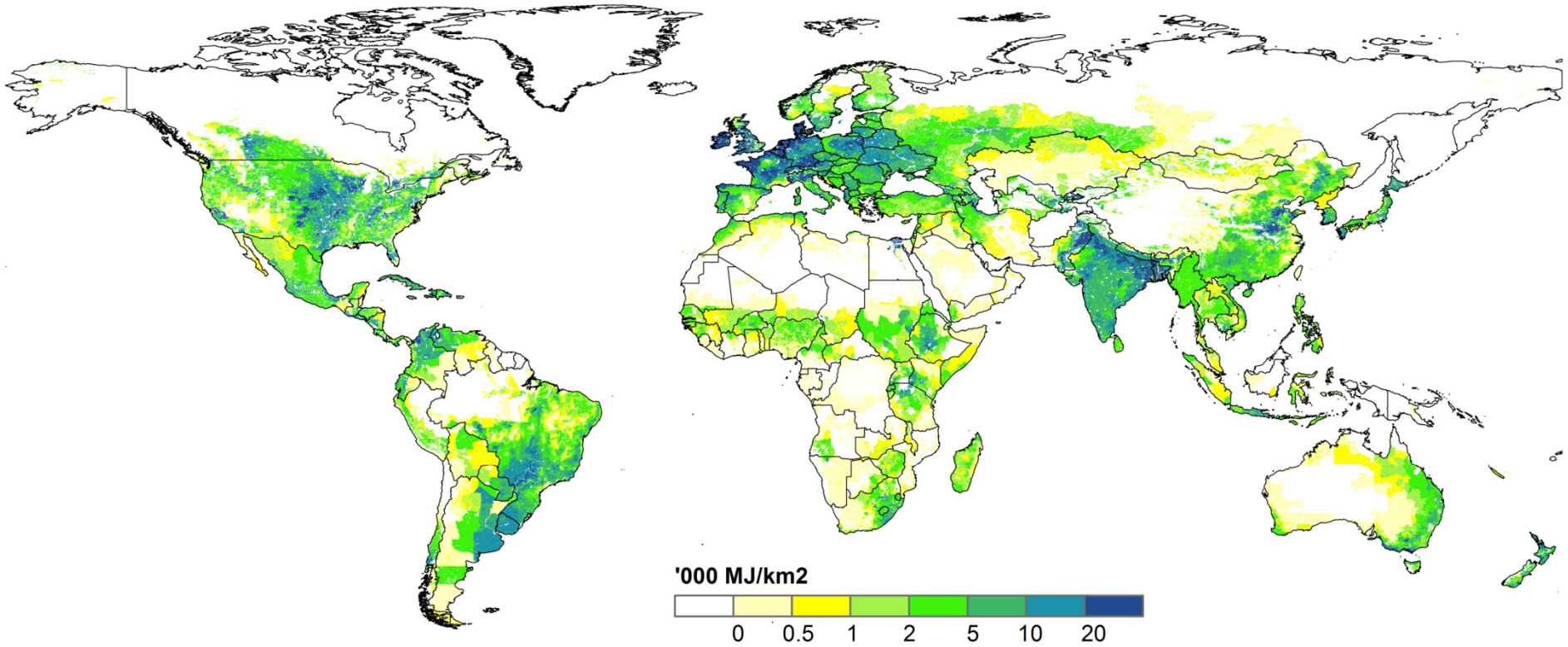


East and Southern African rangelands support modest levels of animal production

....a livestock revolution will not occur in these systems in the magnitude required to meet consumption

Herrero and Thornton 2009

Map 1. Global metabolisable energy intake from ruminants

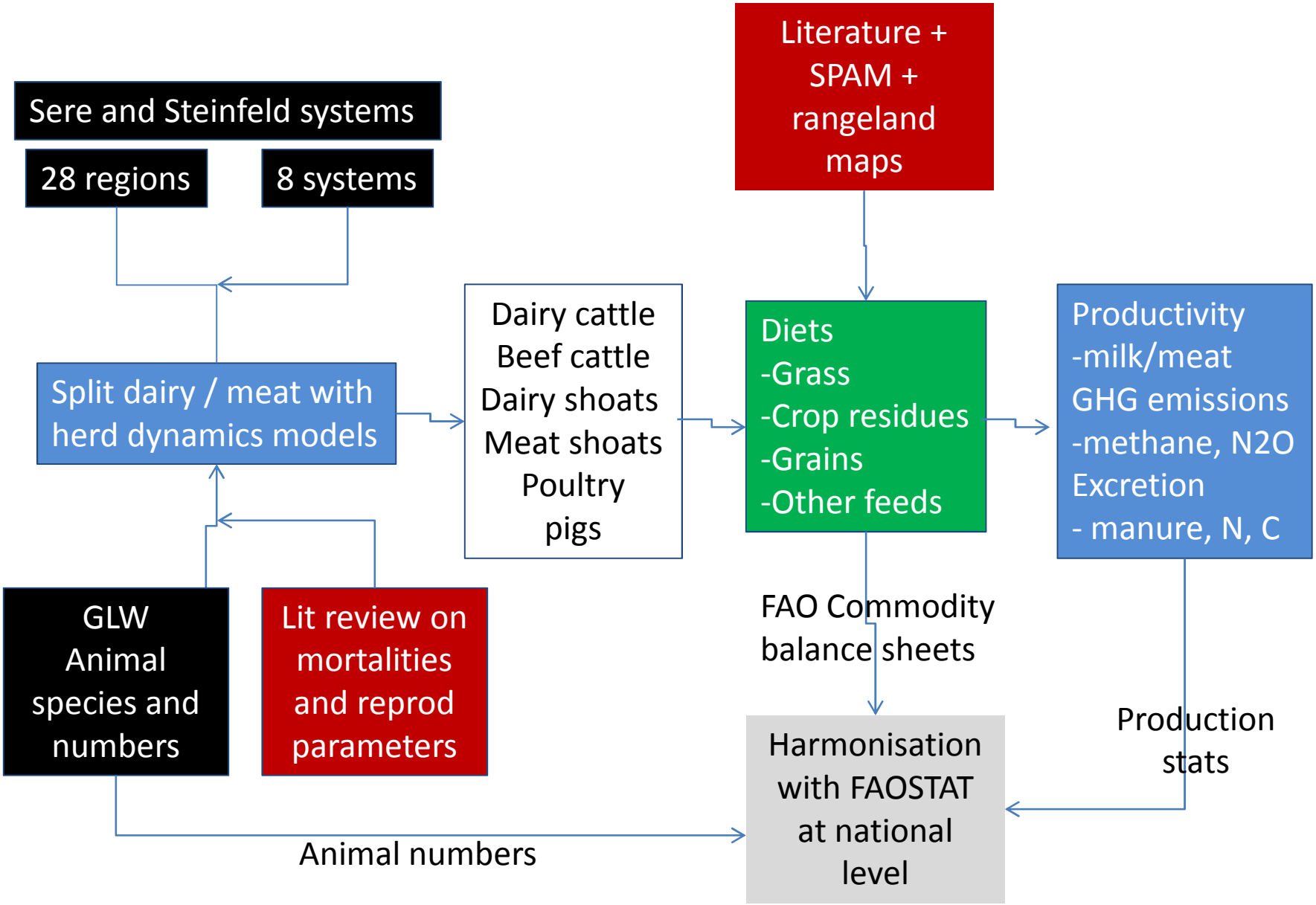


-Feed from all sources: grasses, rangelands, grains, crop residues, cut and carry forages, etc

Herrero et al 2012 forthcoming

Estimating productivity

Developing spatially disaggregated global livestock productivity and emissions maps



Some FAO products to consider

- FAOSTAT
  - National data
  - Crop and livestock production, animal numbers, inputs
  - Incomplete reporting
  - Should be considered a starting point in the absence of local data
- FAO Commodity balance sheets
  - Gives an idea of main feed resources (grains, by-products, others)
  - Gives basic feed trade data
  - …also incomplete reporting

Estimating what animals consume

- Diets estimated for each region from experiments, expert knowledge and literature by:
  - Production system X season (wet or dry)
- Type of feed changed regionally to reflect quality differences
  - Examples:
  - Stover in East Africa assumed to be maize while for West Africa we used millet
  - Cut and carry assumed to be Napier in East Africa but groundnut hay in Southern Africa

Estimating what animals consume

Need quantity and quality for each species, system, animal group

system	dry savanna	humid savanna	Subtrop. savanna	stover	cut and carry	weeds + others	grains
LA	X						
LH		X					
LT			X				
MRA	X			X			
MRH		X		X	X	X	X
MRT			X	X	X	X	X

Stover = rice straw
Cut and carry = napier grass

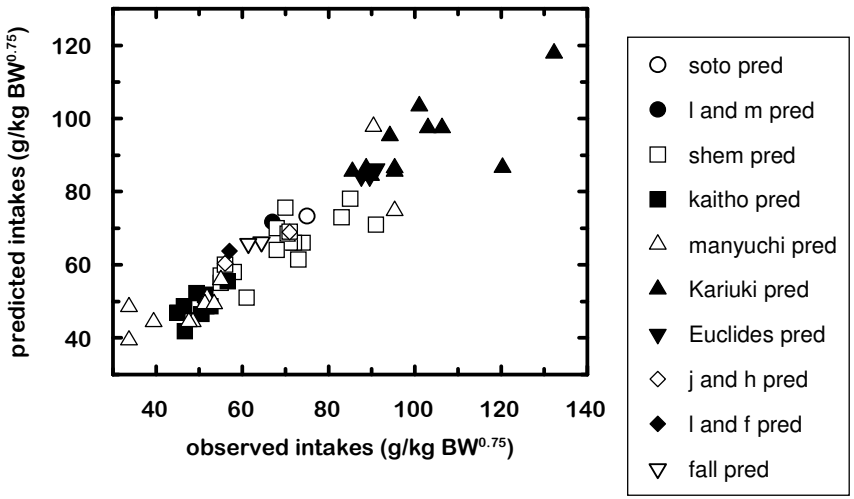
Estimating what animals consume

- Regional splits
- Diets estimated for each region from experiments, expert knowledge, household surveys and literature by:
  - Species X Production system X season (wet or dry)
- Type of feed changed regionally to reflect quality differences
  - Examples:
  - Stover in East Africa assumed to be maize while for West Africa we used millet
  - Cut and carry assumed to be Napier in East Africa but groundnut hay in Southern Africa
- Modelling of animal production …Tier 2/3
- or real systems data!

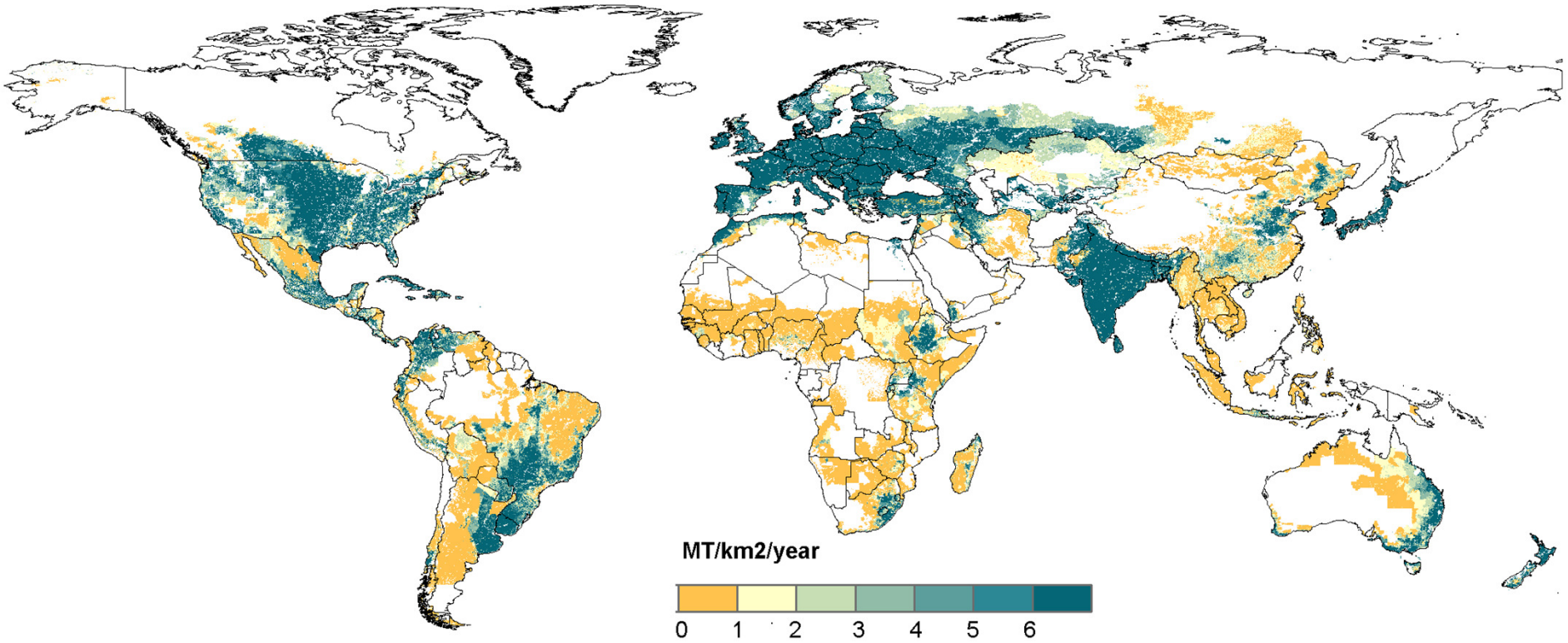
The RUMINANT Simulation model

- Dynamic simulation model of digestion in ruminants (Herrero et al 2004) largely based on IPCC methods
- Predicts intake, production (milk, meat), and excretion (faeces and urine) using a dynamic model of digestion (Illius and Gordon 1991)
- Predicts metabolism end products (METHANE, Volatile fatty acids, etc)
- Uses known stoichiometric relationships
- Widely validated in the tropics
- Used in a range of studies with cattle, sheep and goats

Prediction of intake



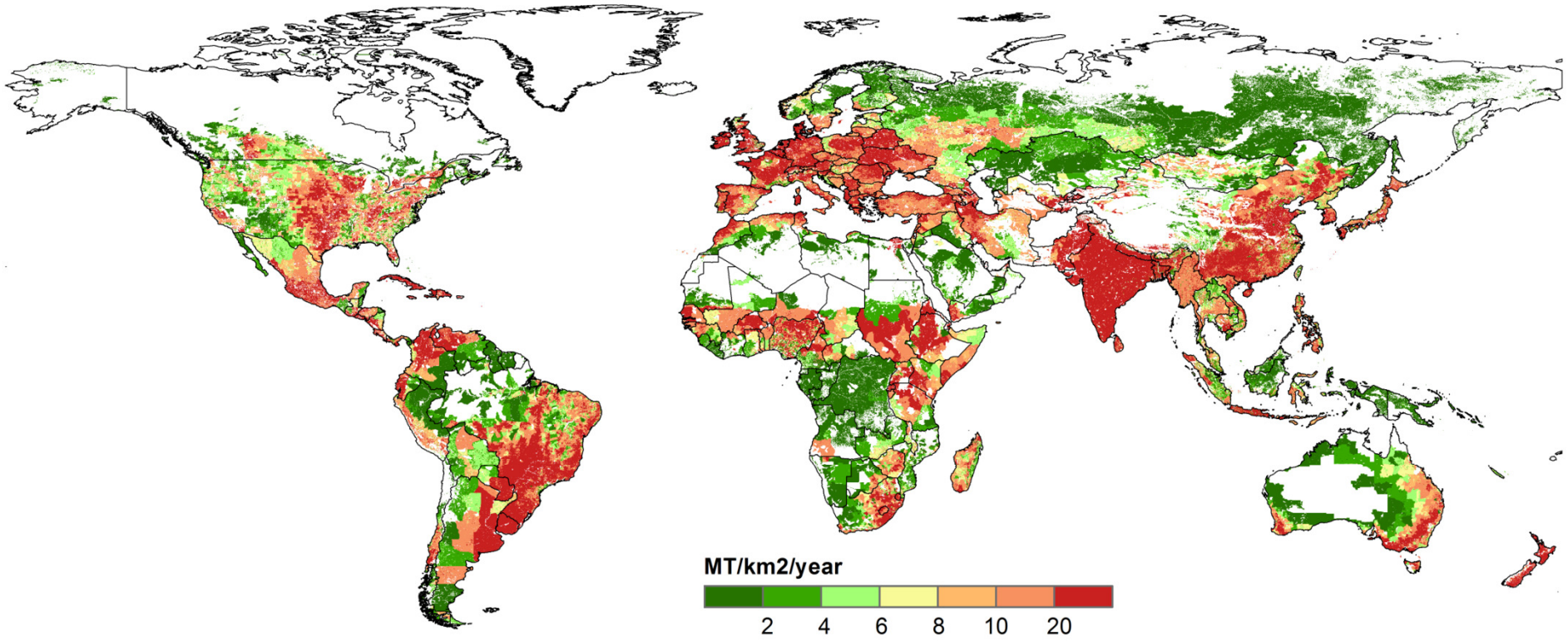
Global milk production



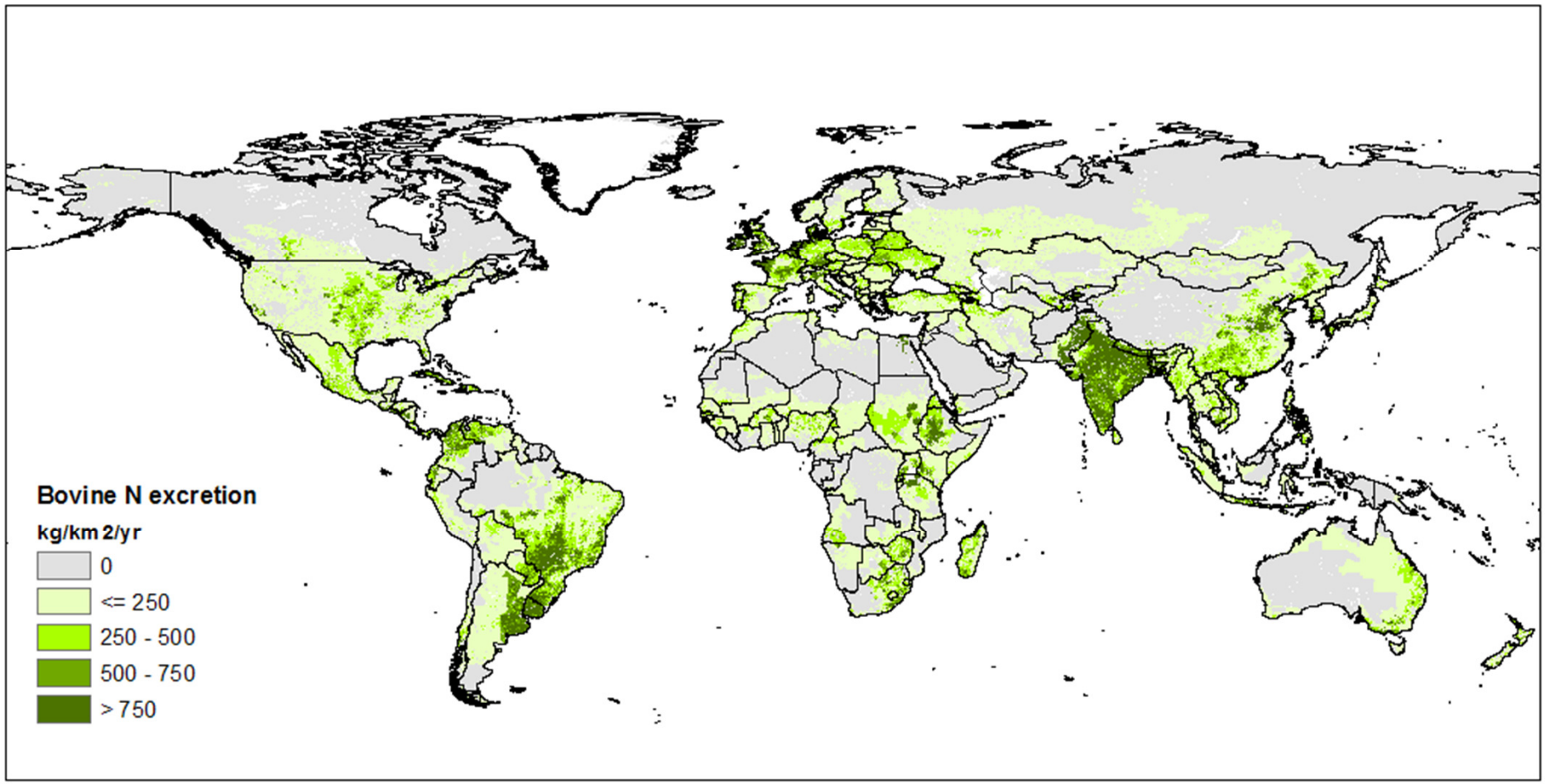
Herrero et al 2012 forthcoming

Other dimensions

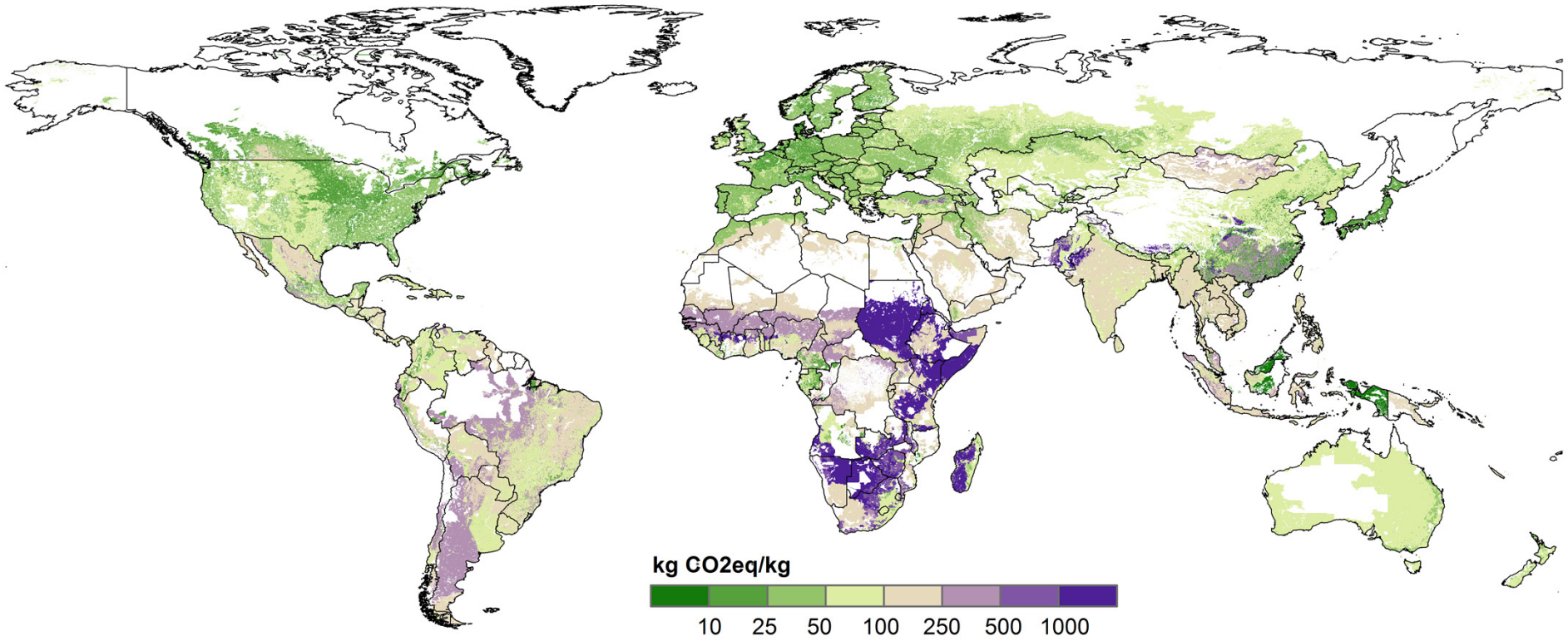
Map 5.
Global manure production from domestic livestock (ruminants and monogastrics)



Global nitrogen excretion from bovines

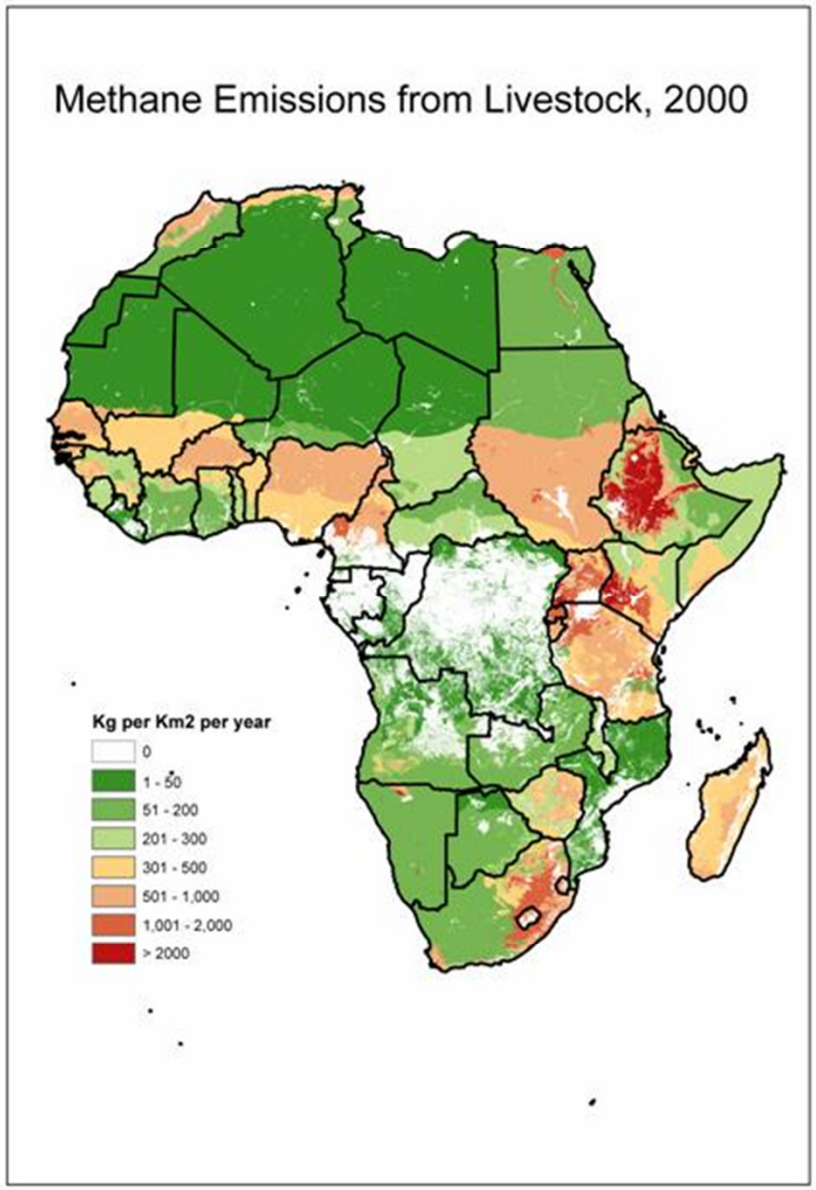


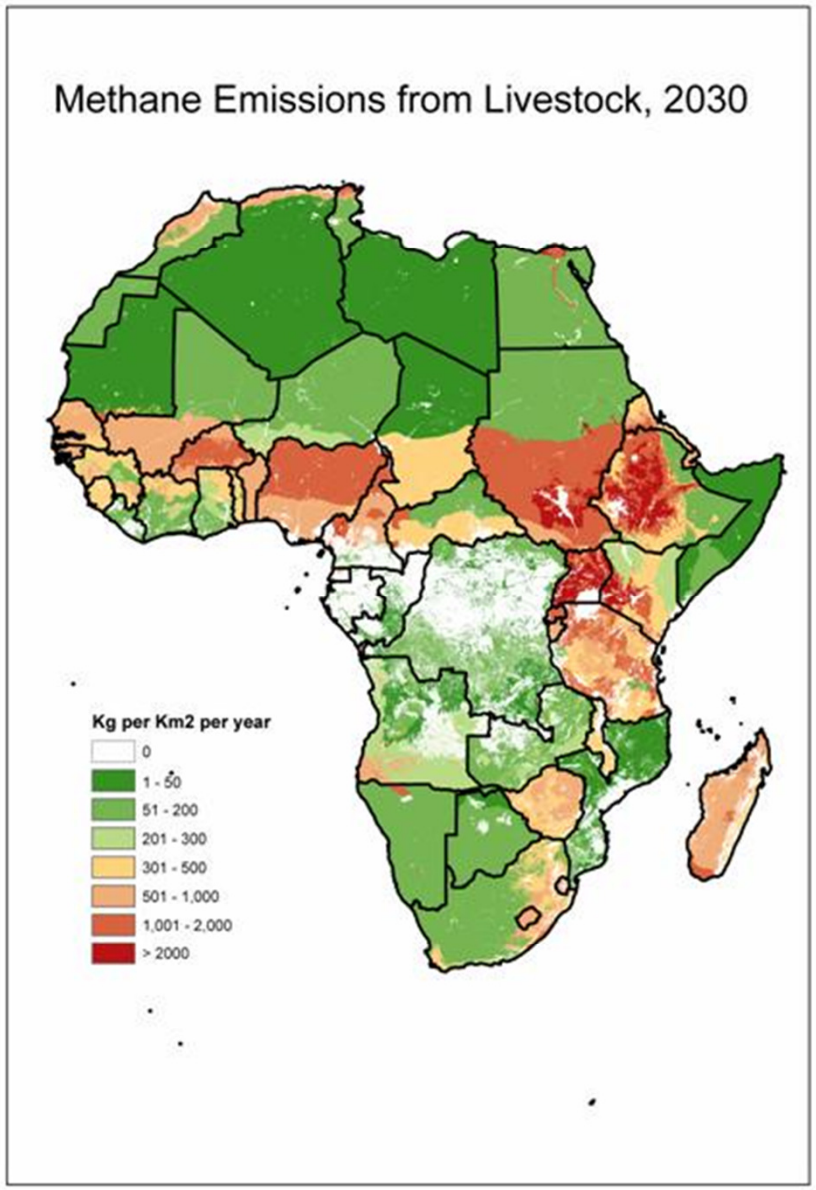
Global greenhouse gas efficiency per kilogram of animal protein



-Includes emissions from enteric fermentation and manure management
-Included: cattle, shoats, pigs and products: milk, beef, pork.

Herrero et al (PNAS forthcoming)

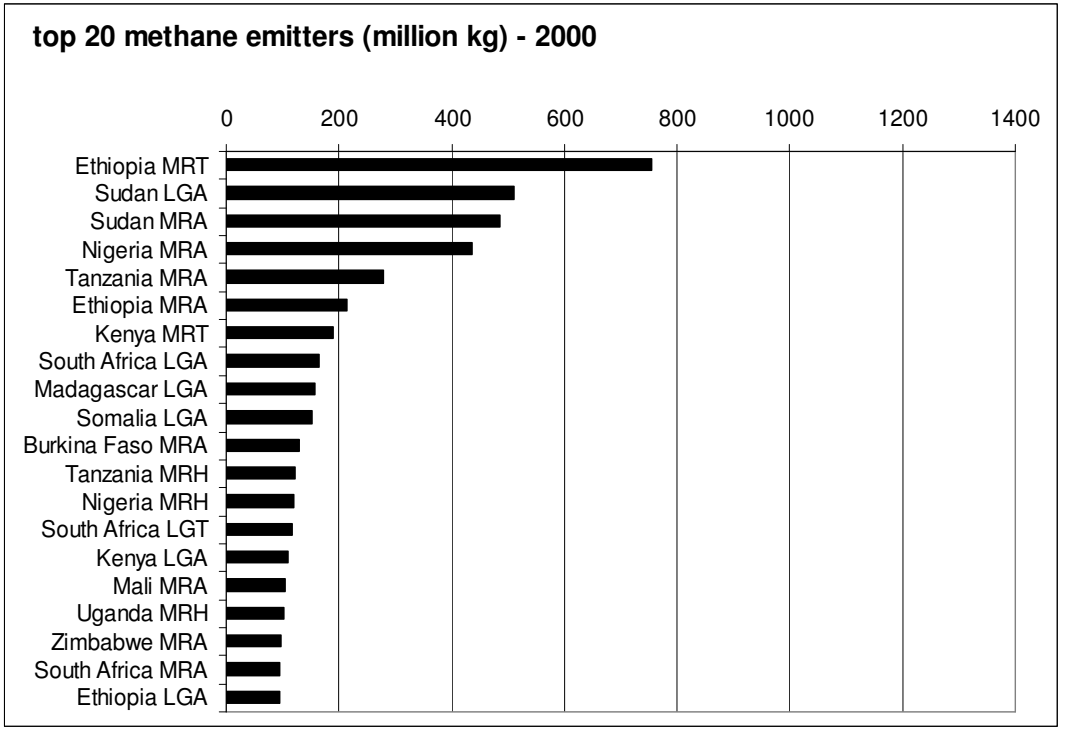

Methane Emissions from Livestock, 2000
Kg per Km2 per year
0
1 - 50
51 - 200
201 - 300
301 - 500
501 - 1,000
1,001 - 2,000
> 2000

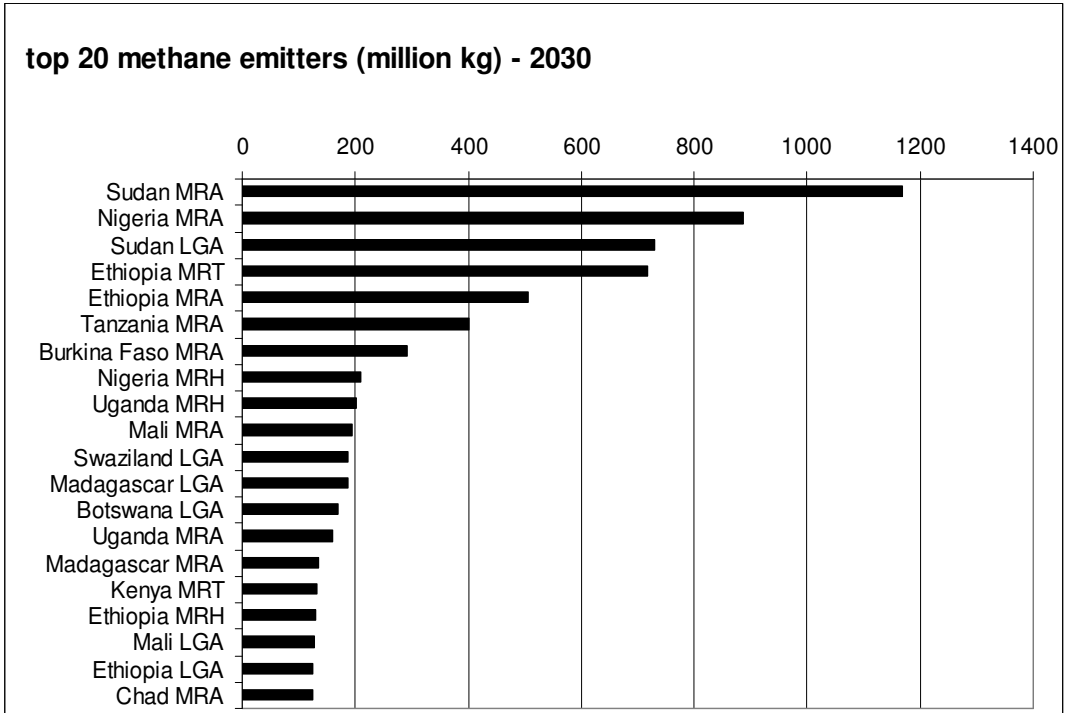

Methane Emissions from Livestock, 2030
Kg per Km2 per year
0
1 - 50
51 - 200
201 - 300
301 - 500
501 - 1,000
1,001 - 2,000
> 2000

Africa - Shifts in methane production as systems evolve to 2030

linking livestock numbers to SRES scenarios

important to evaluate mitigation strategies





Conclusions

- Better data comes out of integrated methodologies:
  - Spatial products
  - Experiments and real measurements
  - Household-level data (surveys)
  - Expert knowledge
  - Livestock models
  - Census and other statistics

Research needs

- Need better local data to supplement existing efforts (how to collate it, standardise it, etc)
- Need robust measurements (how to make them representative?
- We don't know where smallholders are, nor their share of production
- Spatial distribution of animals can be improved – notably monogastrics (we don't know where they are)
- Joint crop and livestock classification (real SPAM)
- Proxies for systems intensification that are robust cross landscapes
- Linkages to market access
- Need better spatial coverage of fodders (ok for stover and grass) – we only account spatially for 60-70% of feed in some systems
- Need to refine productivities and yield gaps work and constraints to production

Mitigation…moving beyond inventories

- Mitigation needs to go beyond inventories to understand options at the household level
- To understand trade-offs and synergies between adaptation and mitigation
- Competing use of resources
- Upscaling strategies and mitigation potentials of specific regions

Thank you