Data availability in FAO and associated methods

30 November 2015, Kigali, Rwanda

International Workshop

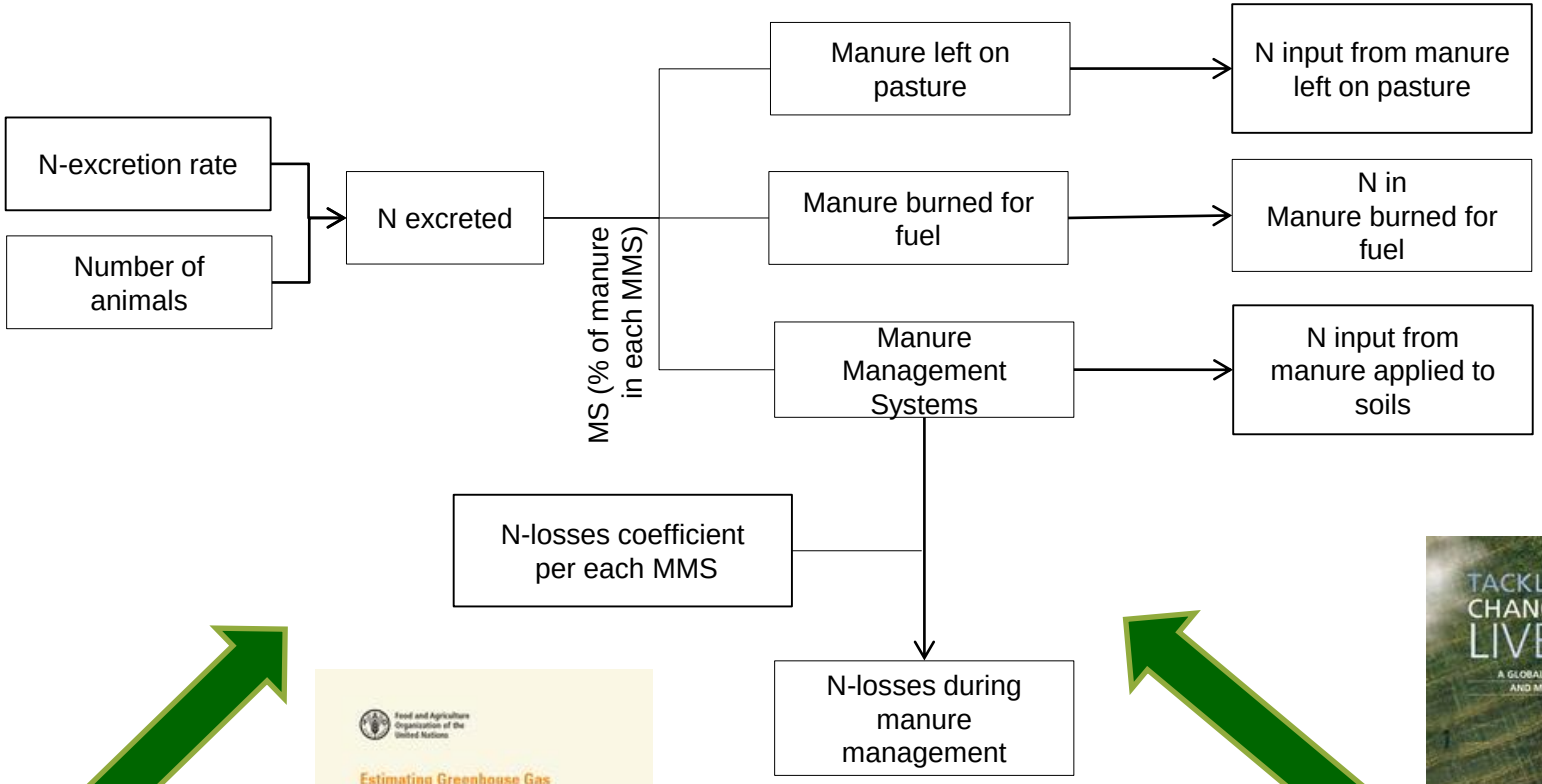
Statistics on nitrogen input from livestock manure: Estimating availability and use

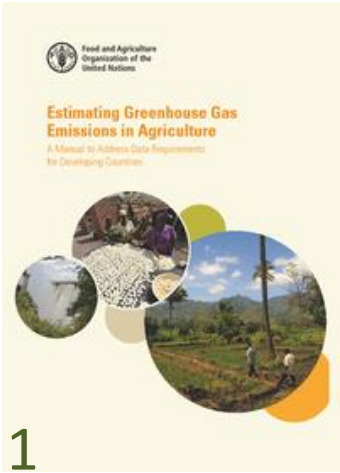
Food and Agriculture Organization
of the United Nations

Summary

- Specific Data components
- FAO contributions:
  - FAOSTAT
  - GLEAM
  - New Work on linking FAOSTAT and GLEAM

Generic Data and Modeling Framework for Manure N

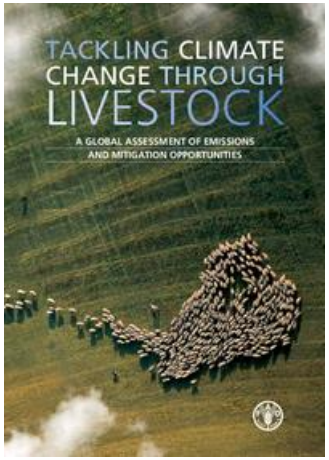




FAOSTAT

IPCC 2006

Reference Tier 1



GLEAM

Tier 2/3

Manure Data within FAOSTAT (Emissions Database):

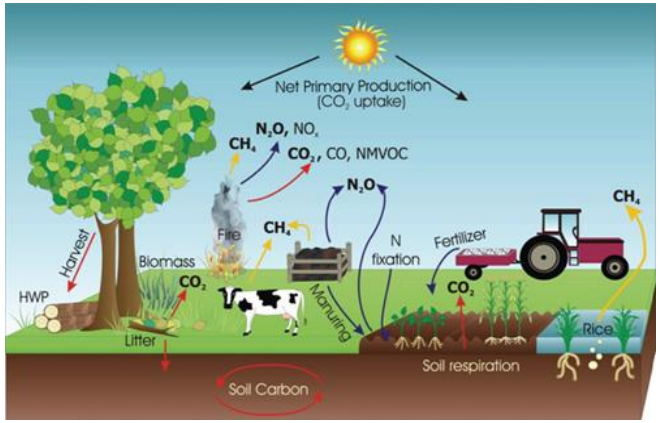
Food and Agriculture Organization of the United Nations
FAOSTAT

& geo-reference data

+

IPCC 2006 Guidelines

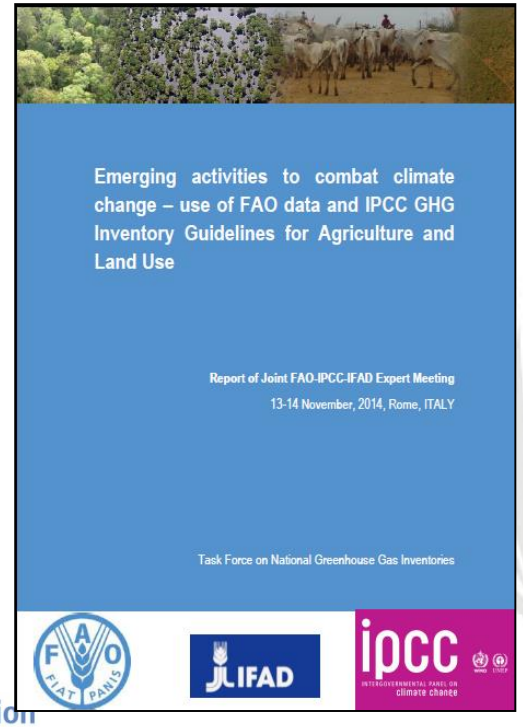
=

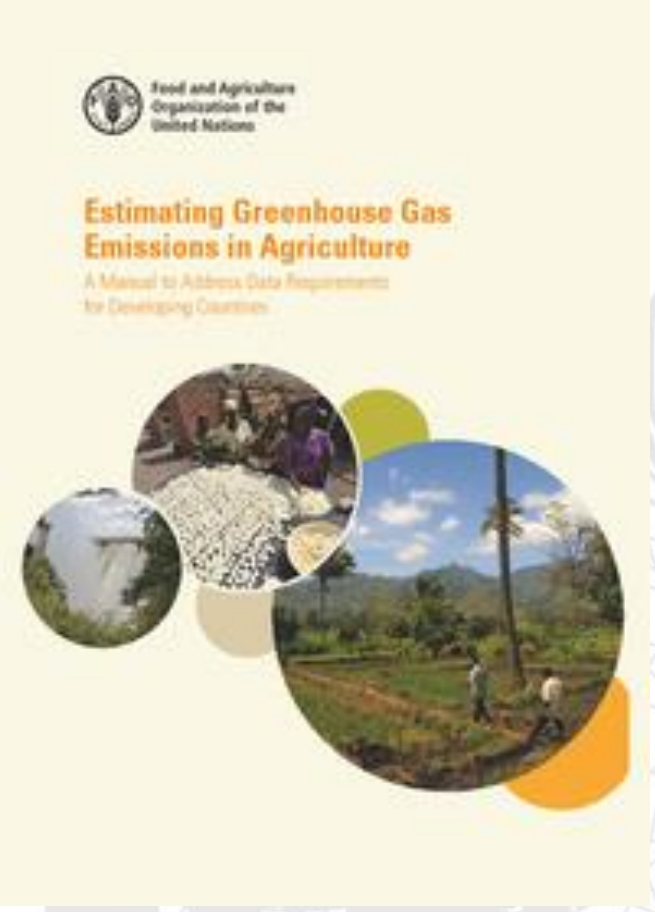


Food and Agriculture Organization of the United Nations

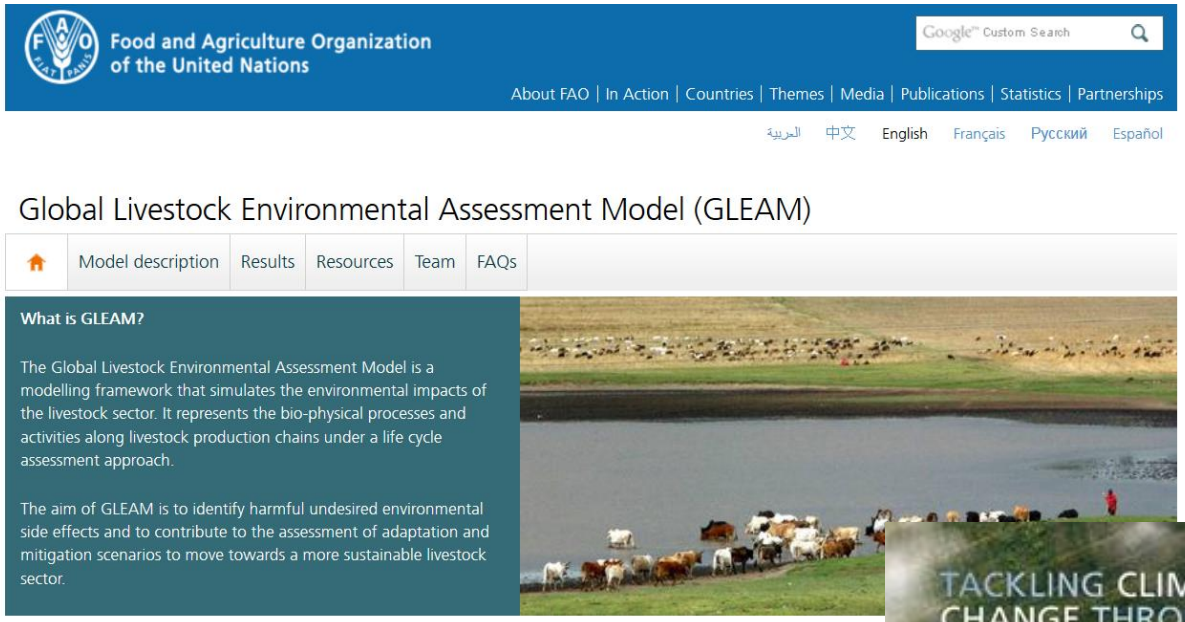
FAOSTAT http://faostat3.fao.org/home/E

Database on Emissions (available in FAOSTAT since 2012)





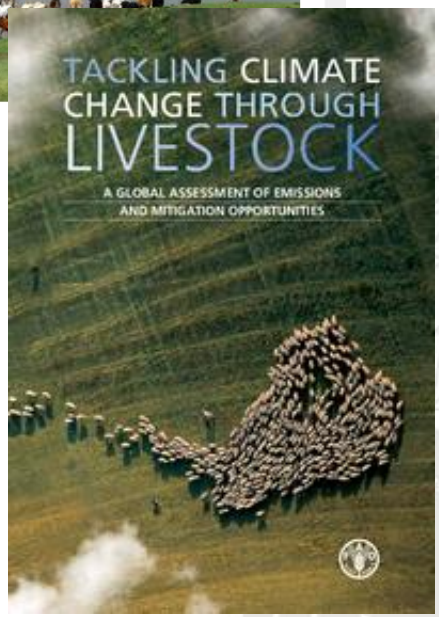
Global Livestock Environment Assessment Model (**GLEAM**)



GLEAM model in brief

GLEAM is a modelling framework that simulates the interaction of activities and processes involved in livestock production and the environment. The model is developed to assess livestock's impacts, adaptation and mitigation options at (sub)national, regional and global scale.

GLEAM differentiates key stages along livestock supply chains such as feed production, processing and transport; herd dynamics, animal feeding and manure management; and animal products processing and transport. The model captures the specific impacts of each stage, offering a comprehensive and disaggregated picture of livestock production negative side effects and a valuable information for intervention.



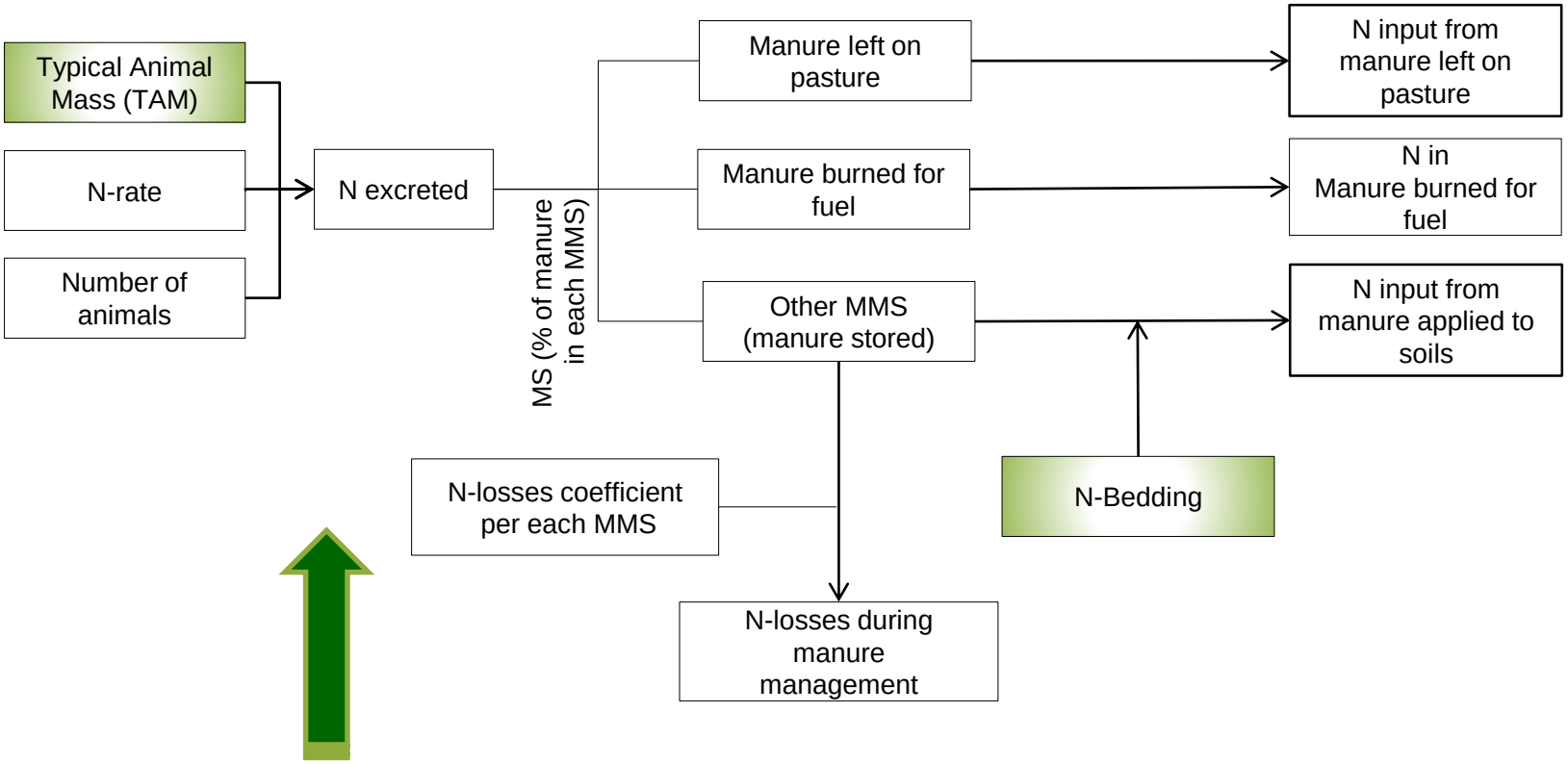
FAO Animal Production and Health division

http://www.fao.org/gleam/en/

Global Livestock Environment Assessment Model (**GLEAM**)

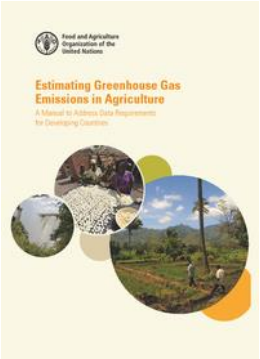
- **Modeling framework that simulates the environmental impacts of the livestock sector**
- **Develop to assess livestock's impacts**
- **Support mitigation and adaptation options at various scales**
- **Assess specific impacts of key stages along the livestock supply chains:**
  - **feed production, processing and transport ;**
  - **herd dynamics, animal feeding and manure management;**
  - **animal products processing and transports**

Manure Data in FAOSTAT



Reference Tier 1 (IPCC 2006) for:

- ✓ N-excretion rate;
- ✓ N-losses by MMS;
- ✓ Share manure left on pasture and applied to soils

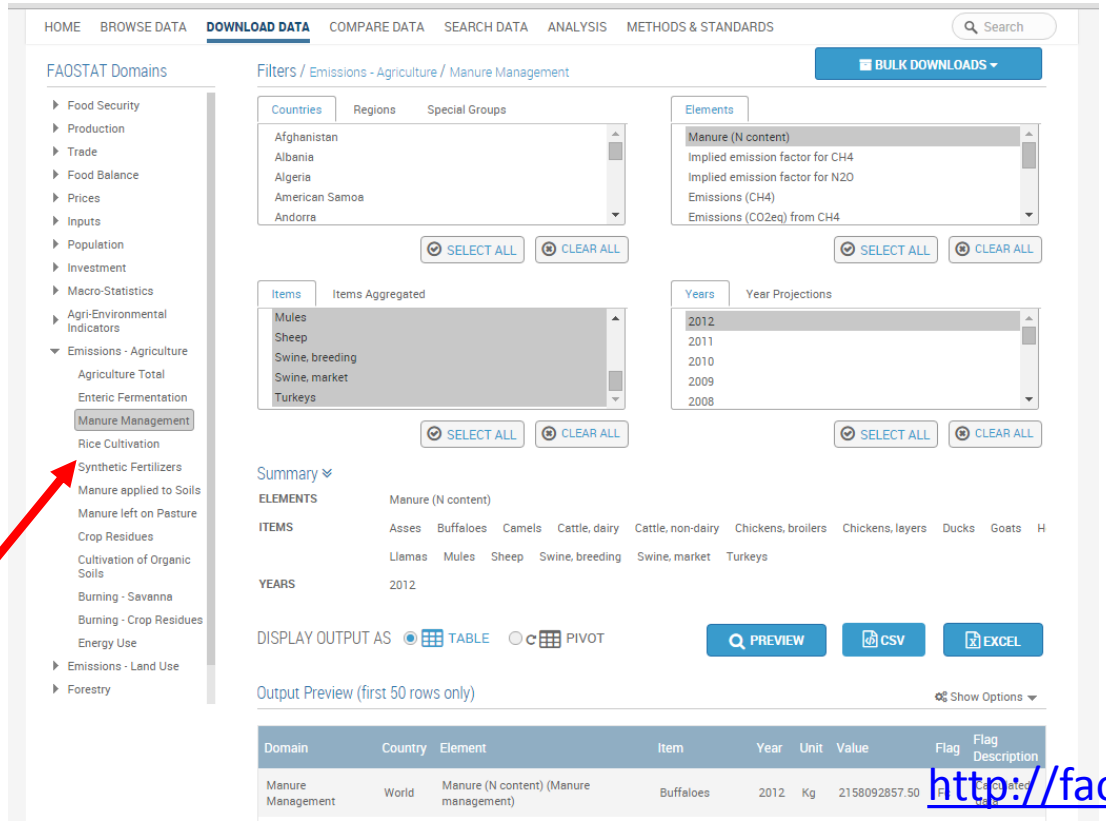


FAOSTAT Manure Management

- **Activity data**
  - Livestock number (heads)

- **Coefficients (IPCC 2006)**
  - Emission Factors, Tier 1, IPCC 2006 for CH_4 and N_2O
  - N losses during manure management

- **Outputs**
  - N content in managed manure
  - Emissions : CH_4 and N_2O and CO_{2eq}



http://faostat3.fao.org/download/G1/GM/E

FAOSTAT

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  - Crops processed
  - Live Animals
  - Livestock Primary
  - Livestock Processed
  - Production Indices
  - Value of Agricultural Production
- Trade
- Food Balance
- Prices
- Inputs
- Population
- Investment
- Macro-Statistics
- Agri-Environmental Indicators
- Emissions - Agriculture
  - Agriculture Total
  - Enteric Fermentation
  - Manure Management
  - Rice Cultivation
  - Synthetic Fertilizers
  - Manure applied to Soils
  - Manure left on Pasture

Filters / Production / Live Animals

BULK DOWNLOADS

Countries | Regions | Special Groups

Afghanistan
Albania
Algeria
American Samoa
Andorra

SELECT ALL | CLEAR ALL

Elements

Stocks

SELECT ALL | CLEAR ALL

Items | Items Aggregated

Animals live nes
Asses
Beehives
Buffaloes
Camelids, other

SELECT ALL | CLEAR ALL

Years

2013
2012
2011
2010
2009

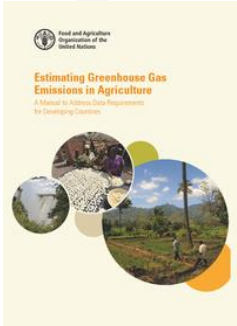
SELECT ALL | CLEAR ALL

Summary

ELEMENTS Stocks

DISPLAY OUTPUT AS TABLE PIVOT

PREVIEW | CSV | EXCEL



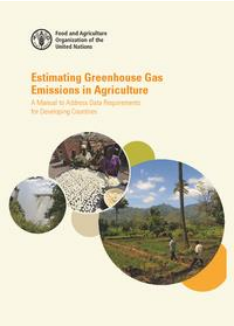
http://faostat3.fao.org/home/E

FAOSTAT Manure applied to soils

- **Activity data: total amount of manure (in kg of N yr^{-1} that is applied to soil)**

Relevant coefficients / parameters IPCC 2006 :

- N excretion coefficients (N_{ex}). Varying by species and region;
- Default % of N treated in different Manure Management Systems (MMS) (by region);
- Default IPCC values for total N losses in different MMS;
- Default amount of N used in bedding



- **Outputs**

- N applied to soils
- Associate emissions (default IPCC 2006 values)

FAOSTAT

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FAOSTAT Domains

- Inputs
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- Investment
- Macro-Statistics
- Agri-Environmental Indicators
- Emissions - Agriculture
  - Agriculture Total
  - Enteric Fermentation
  - Manure Management
  - Rice Cultivation
  - Synthetic Fertilizers
  - Manure applied to Soils
  - Manure left on Pasture
  - Crop Residues
  - Cultivation of Organic Soils
  - Burning - Savanna
  - Burning - Crop Residues
  - Energy Use
- Emissions - Land Use
  - Land Use Total
  - Forest Land
  - Cropland
  - Grassland
  - Burning - Biomass
- Forestry

Filters / Emissions - Agriculture / Manure applied to Soils

BULK DOWNLOADS

Countries | Regions | Special Groups

Afghanistan
Albania
Algeria
American Samoa
Andorra

SELECT ALL | CLEAR ALL

Elements

Manure (N content)
Implied emission factor for N2O
Direct emissions (N2O)
Direct emissions (CO2eq)
Indirect emissions (N2O)

SELECT ALL | CLEAR ALL

Items | Items Aggregated

Asses
Buffaloes
Camels
Cattle, dairy
Cattle, non-dairy

SELECT ALL | CLEAR ALL

Years | Year Projections

2012
2011
2010
2009
2008

SELECT ALL | CLEAR ALL

Summary

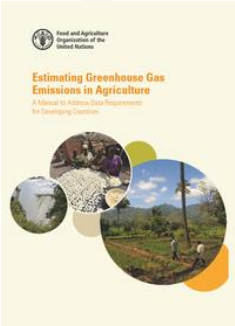
Please use the selectors above to filter your query. Your selection will be displayed in the area below and it can be edited at any time.

DISPLAY OUTPUT AS TABLE PIVOT

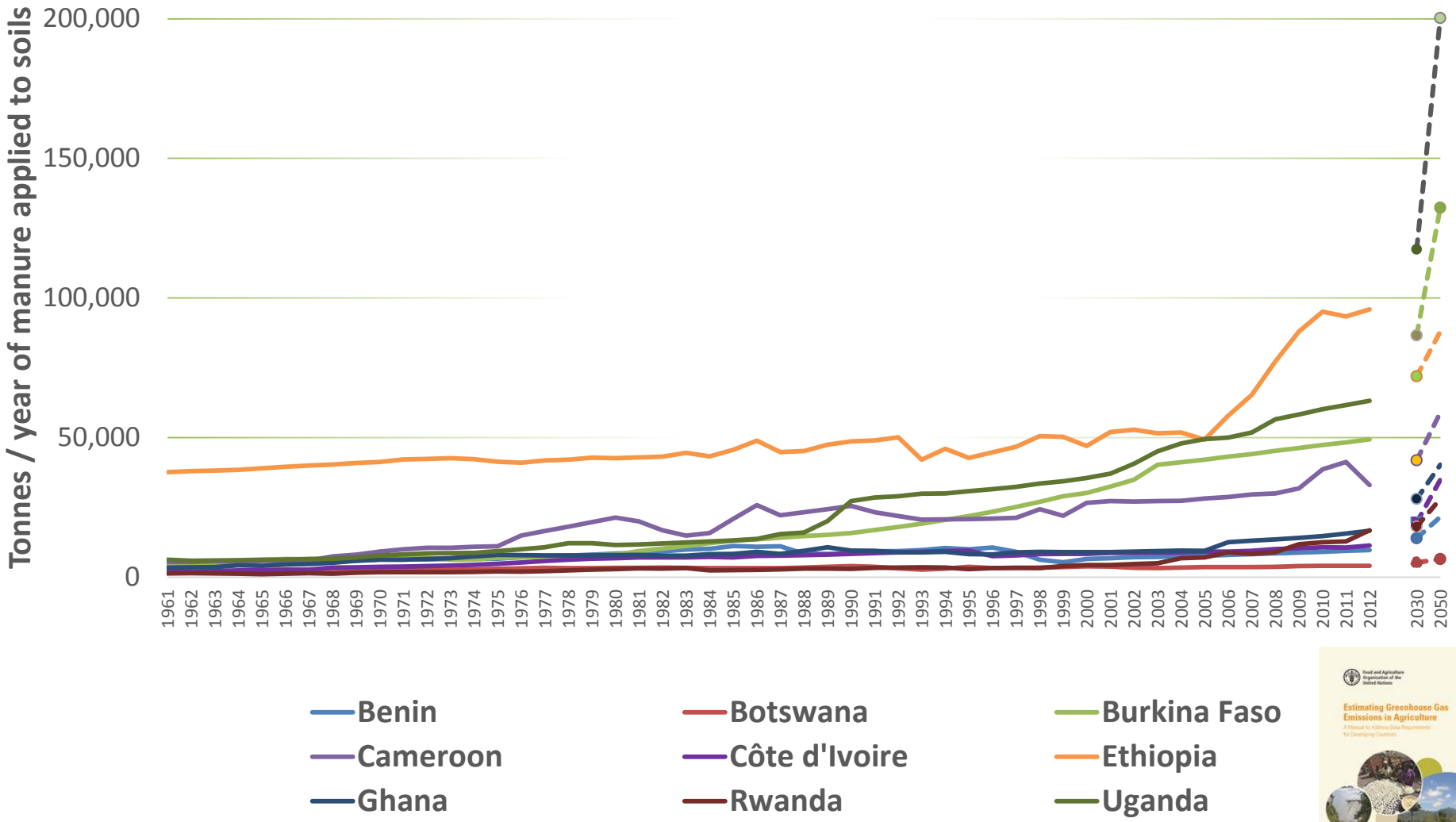
PREVIEW | CSV | EXCEL

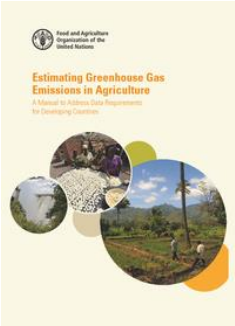
Relevant domains under Emissions from Agriculture: Manure Applied to Soils

http://faostat3.fao.org/download/G1/GM/E

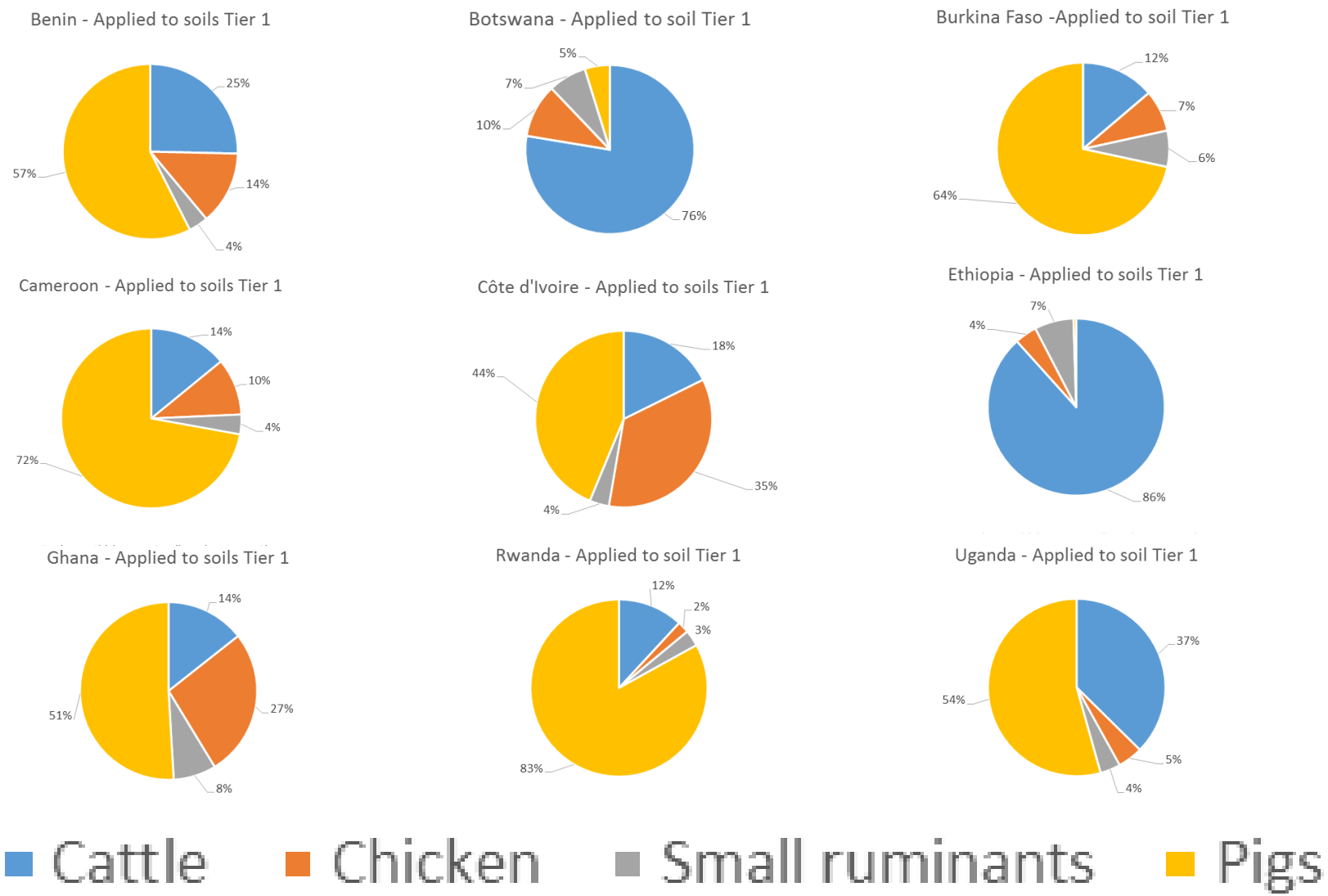


FAOSTAT 1961 – 2012 Manure applied to soils





Livestock species contribution for manure applied to soils

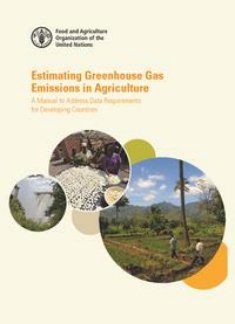


FAOSTAT Manure left on pastures

- **Activity data: total amount of manure (in kg of N yr^{-1} that is left on pastures)**

Relevant coefficients / parameters IPCC 2006 :

- N excretion coefficients (N_{ex}) contained in urea and dung. Varying by species and region;



- **Outputs**

- N left on pastures
- Associate emissions (default IPCC 2006 EFs)

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  - Cultivation of Organic Soils
  - Burning - Savanna
  - Burning - Crop Residues
  - Energy Use
- Emissions - Land Use

Filters / Emissions - Agriculture / Manure left on Pasture

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Countries | Regions | Special Groups

Afghanistan
Albania
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American Samoa
Andorra

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Elements

Manure (N content)
Implied emission factor for N2O
Direct emissions (N2O)
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Items | Items Aggregated

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Cattle, non-dairy

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Years | Year Projections

2012
2011
2010
2009
2008

SELECT ALL | CLEAR ALL

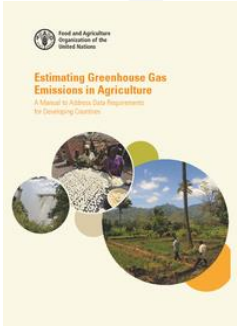
Summary

Please use the selectors above to filter your query. Your selection will be displayed in the area below and it can be edited at any time.

DISPLAY OUTPUT AS TABLE PIVOT

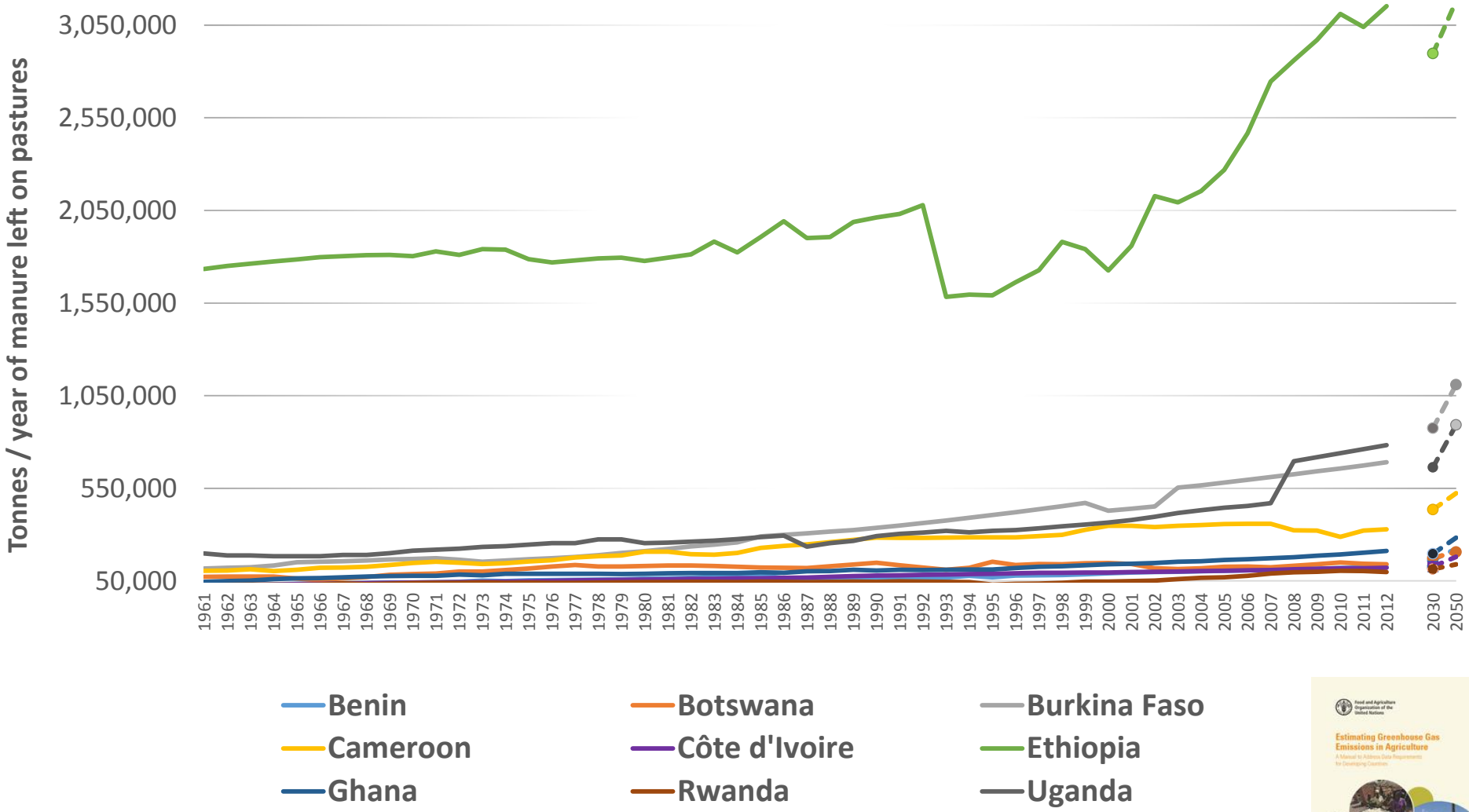
PREVIEW | CSV | EXCEL

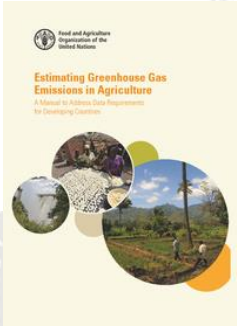
Relevant domains under Emissions from Agriculture: Manure Left on Pastures



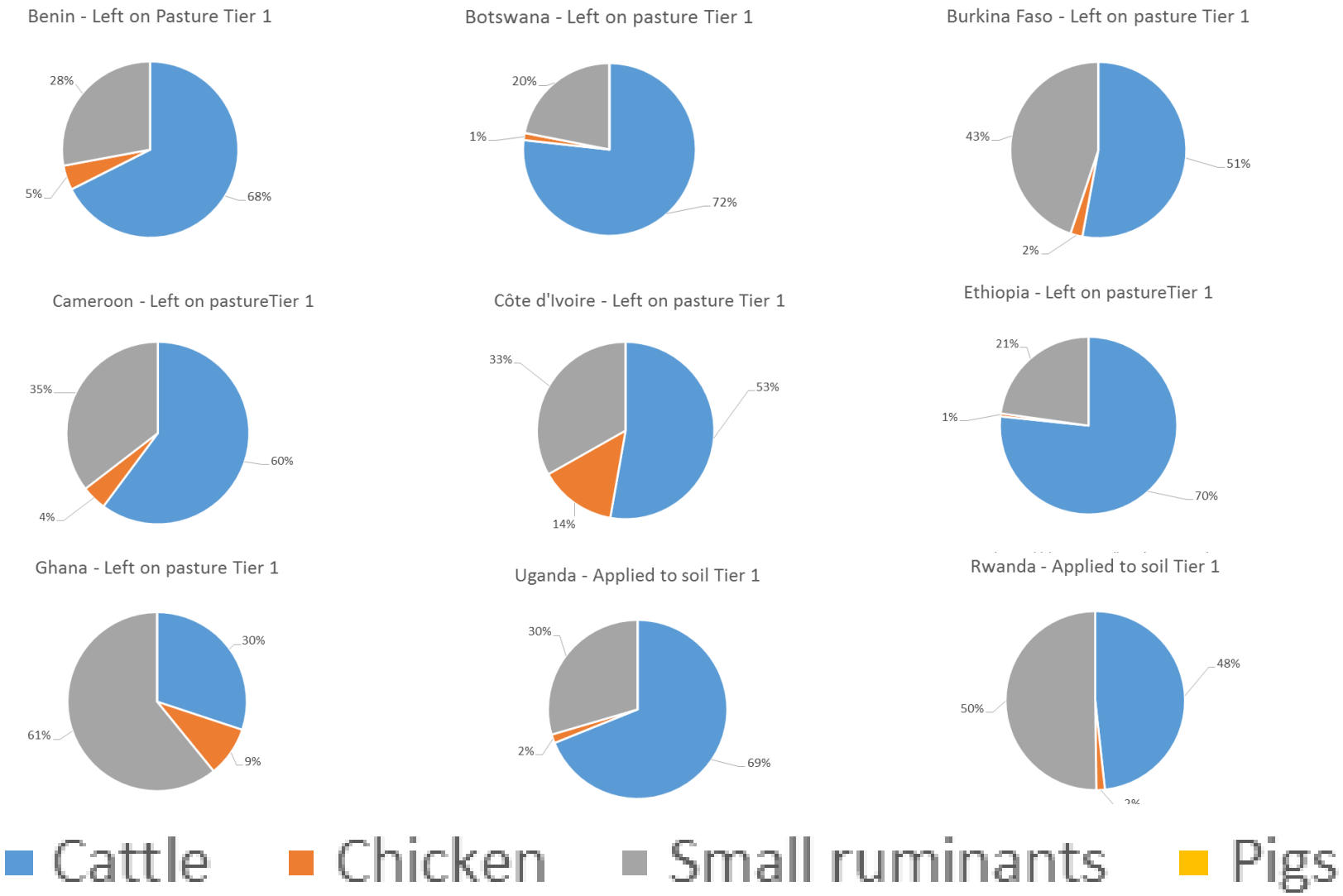
http://faostat3.fao.org/download/G1/GP/E

FAOSTAT 1961 – 2012 Left on pastures





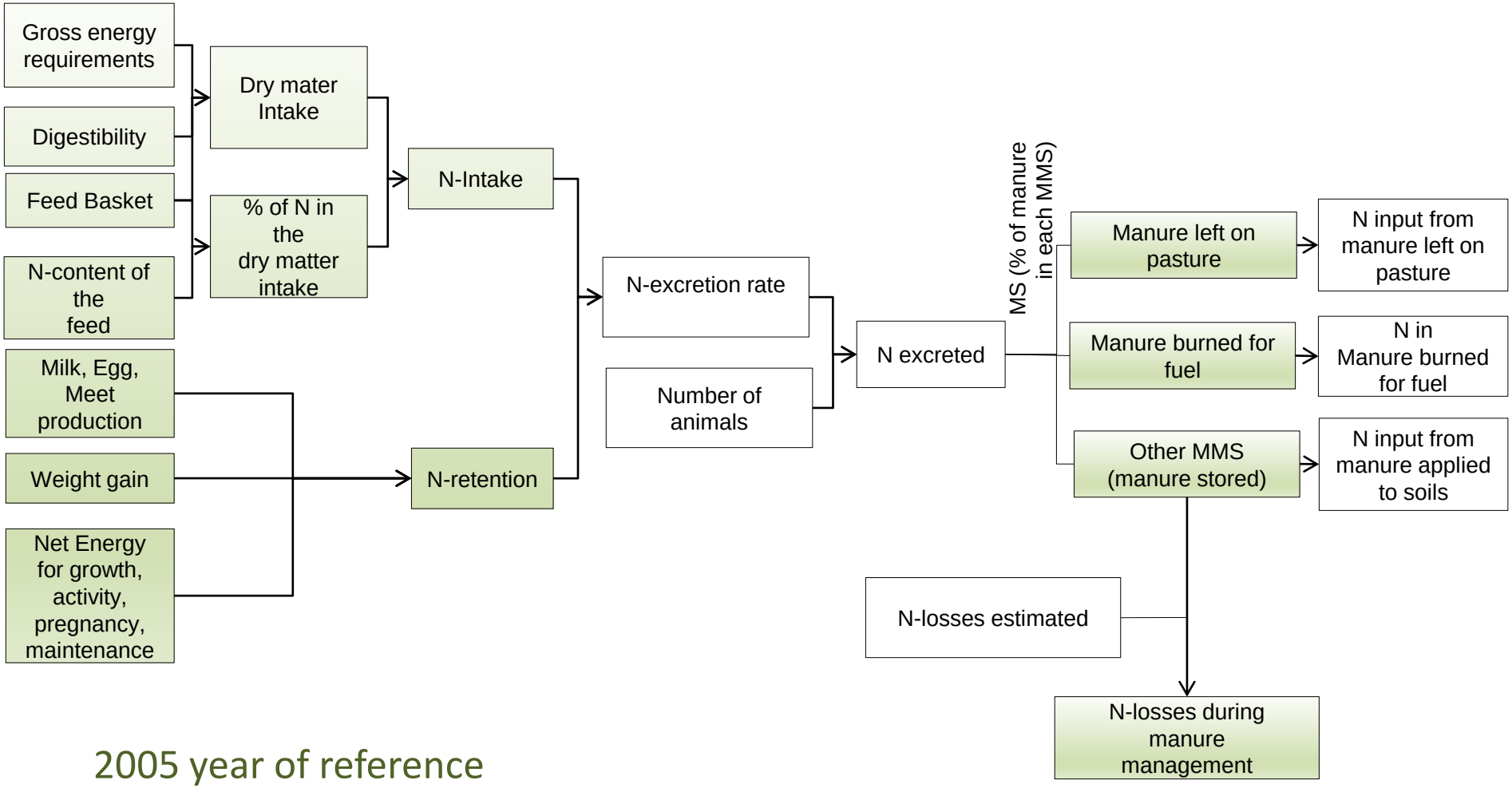
Livestock species contribution for manure left on pastures



FAOSTAT projections for activity data

- ✓ 2030 and 2050 projections
- ✓ Dairy and non-dairy cattle, buffaloes, sheep, goats, pigs and poultry
- ✓ Baseline the year circa 2006 (2005-2007 average)
- ✓ Growth rates from FAO perspective studies (Alexandratos and Bruinsma, 2012)

Manure Data in GLEAM

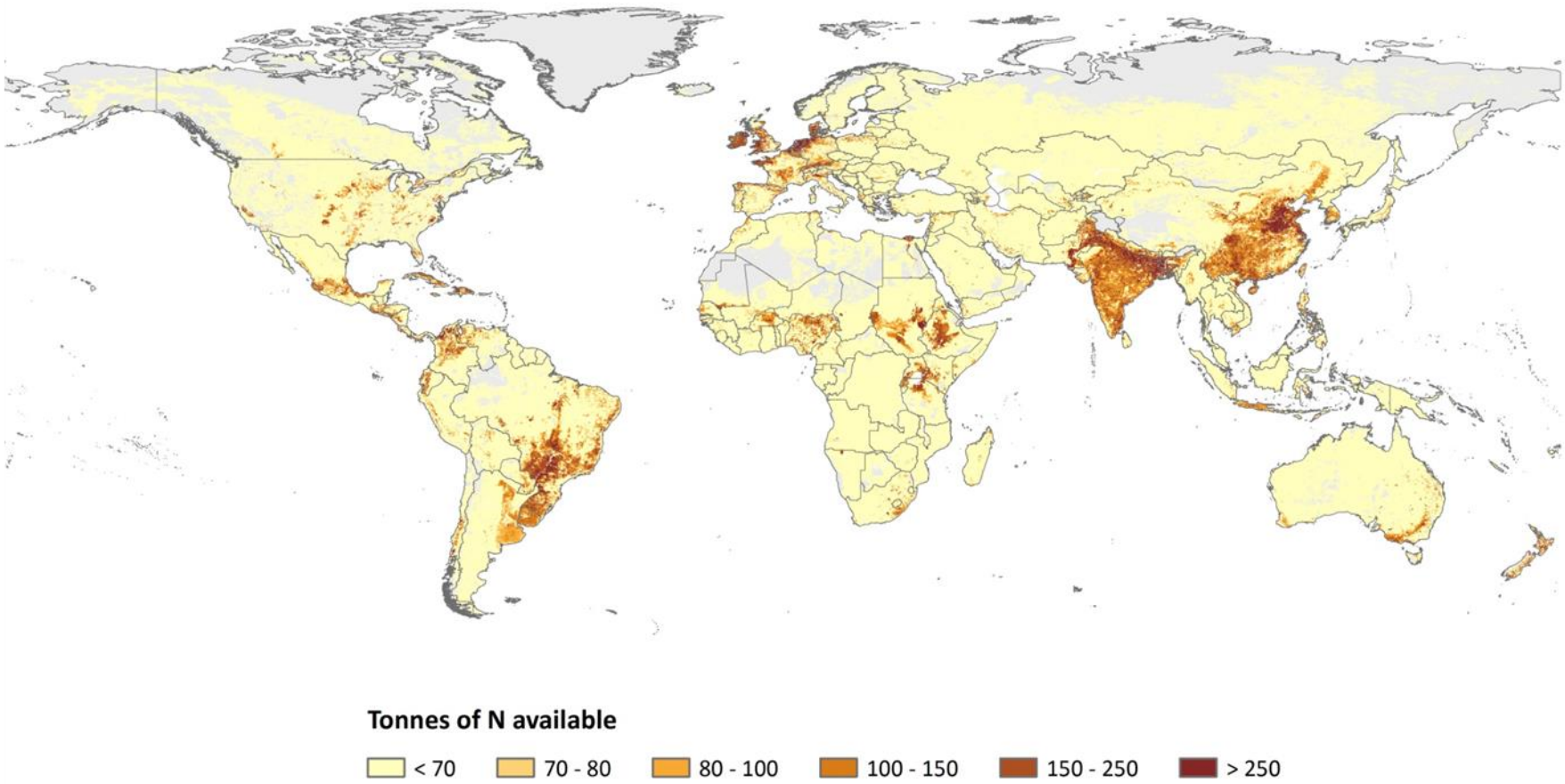


2005 year of reference
A Tier 2 approach

Manure statistics in **GLEAM**

- **Example of a Tier 2 approach**
- **Underline guidelines always IPCC 2006**
- **Country specific coefficients derived from the manure module**
- **GLEAM 1 - year of reference 2005**

Total nitrogen available from manure



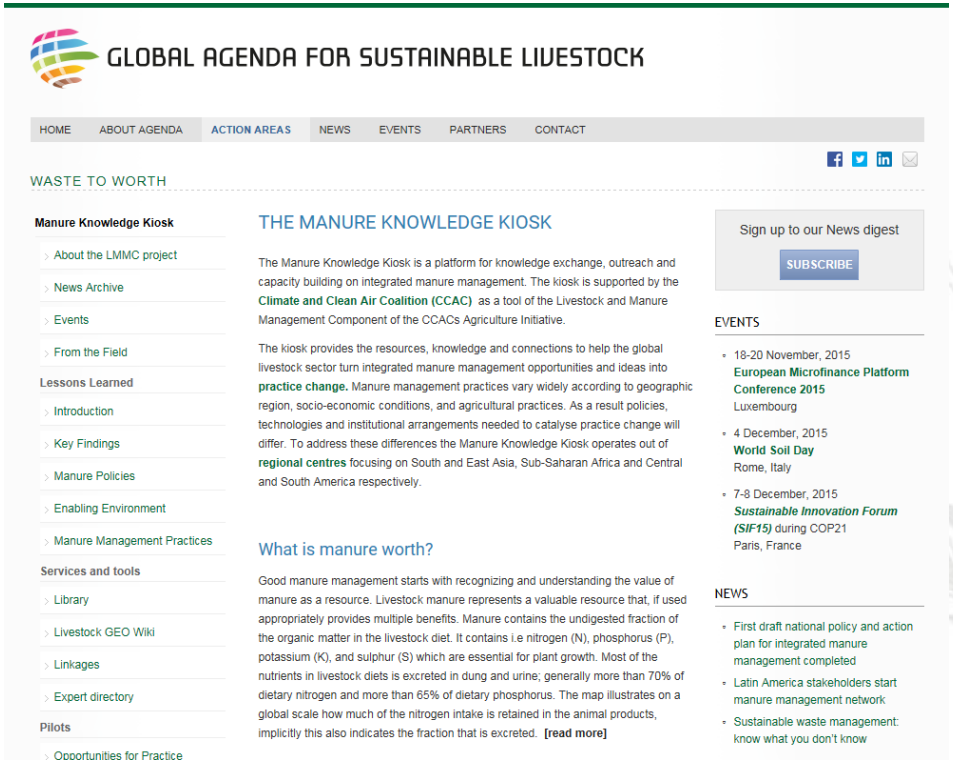
Source: GLEAM

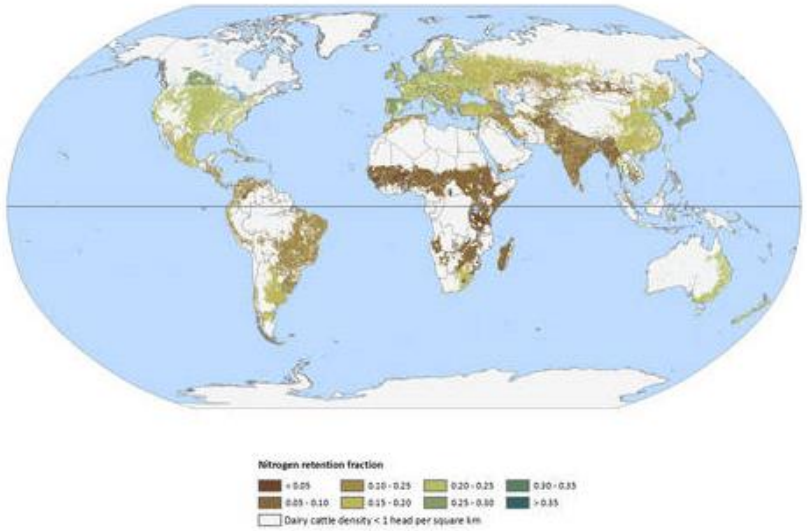
http://www.fao.org/gleam/en/

Manure Knowledge Kiosk

A platform for knowledge exchange, outreach and capacity development on integrated manure management

http://www.manurekiosk.org/

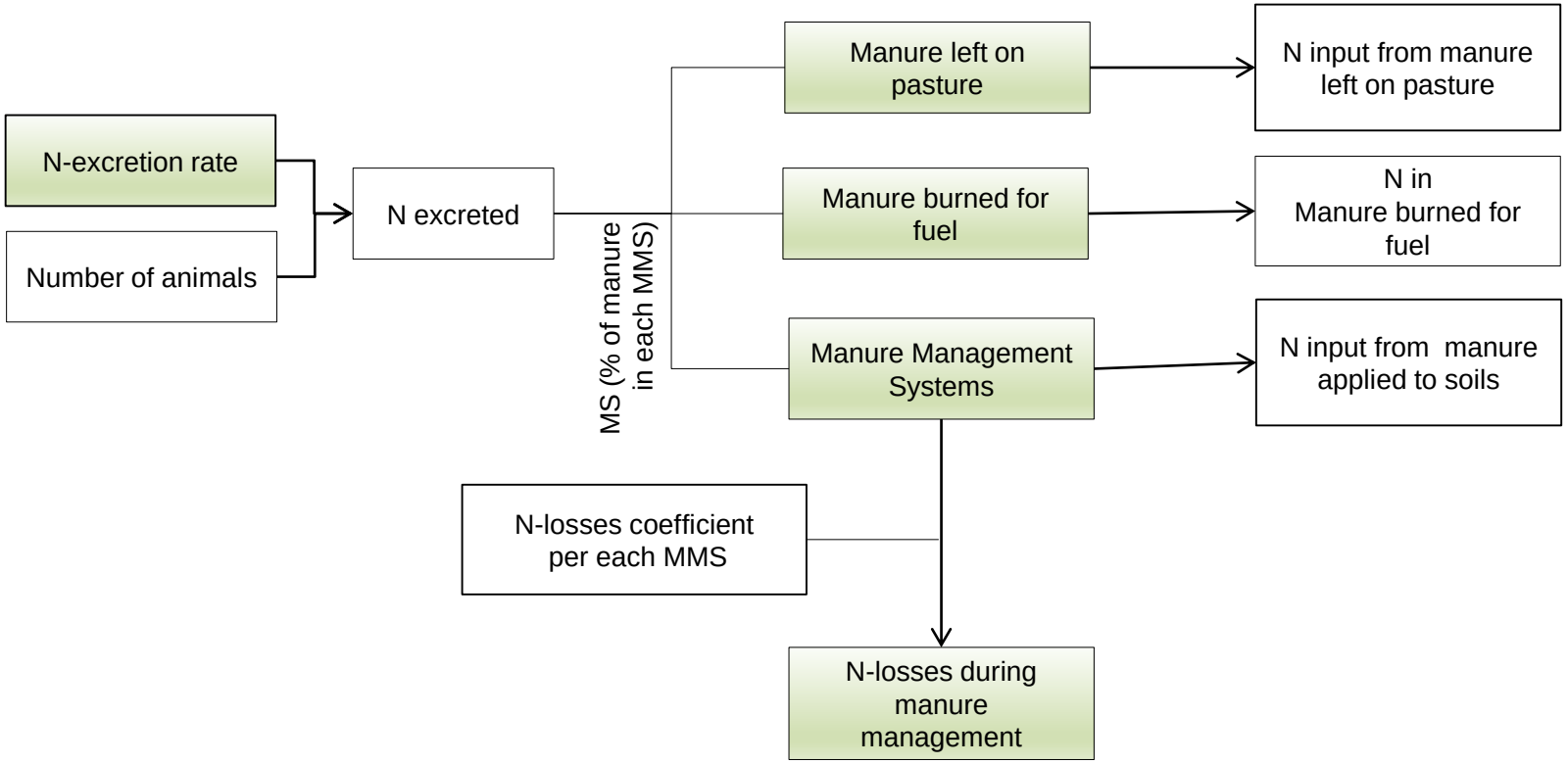




FAO Animal Production and Health division

New Work on Manure Statistics

Simplified TIER 2 coefficients based on the GLEAM livestock model



Country weighted average extracted as a result of country specific herd composition per species, production system, feed basket and intake per cohort (sex, age and function)

Possible Applications

- ✓ Improved quality control to assess robustness of simpler Tier 1 approach
- ✓ Guide in the development of more complex (Tier 2) coefficients better adapted to national conditions
- ✓ Simplified approach for quick appraisal at national level, including setting of robust baselines

FAO is currently collecting results of the above analysis in a Report

Workshop Participants invited to provide feedback and comments based on current workshop discussions and follow-up activities, including comments on final draft in early 2016

Synthesis Results: Aggregated Coefficients

N excretion coefficients at Tier 1 and Tier 2

		CATTLE DAIRY / NO-DAIRY	GOATS	SHEEP	PIGS MARKET / BREEDERS	CHICKEN BROILERS/LAYERS
		kg N per animal per year				
	TIER 1	60.23 / 39.78	15.00	11.96	16.05 / 5.62	0.36 / 0.54
TIER 2 *	BENIN	32.0	4.3	3.1	12.0	0.5
	BOTSWANA	26.7	3.6	3.6	8.9	0.6
	BURKINA FASO	35.1	2.6	3.3	7.6	0.5
	CAMEROON	30.6	2.6	3.5	8.9	0.5
	CÔTE D'IVOIRE	33.6	2.5	2.8	12.8	0.6
	ETHIOPIA	31.1	2.6	2.8	7.6	0.5
	GHANA	32.6	2.4	2.7	10.3	0.5
	RWANDA	28.4	2.3	2.2	6.4	0.5
	UGANDA	37.2	2.4	2.9	6.3	0.5

*Based on 2005 representation with GLEAM

Analysis across Tier Approaches

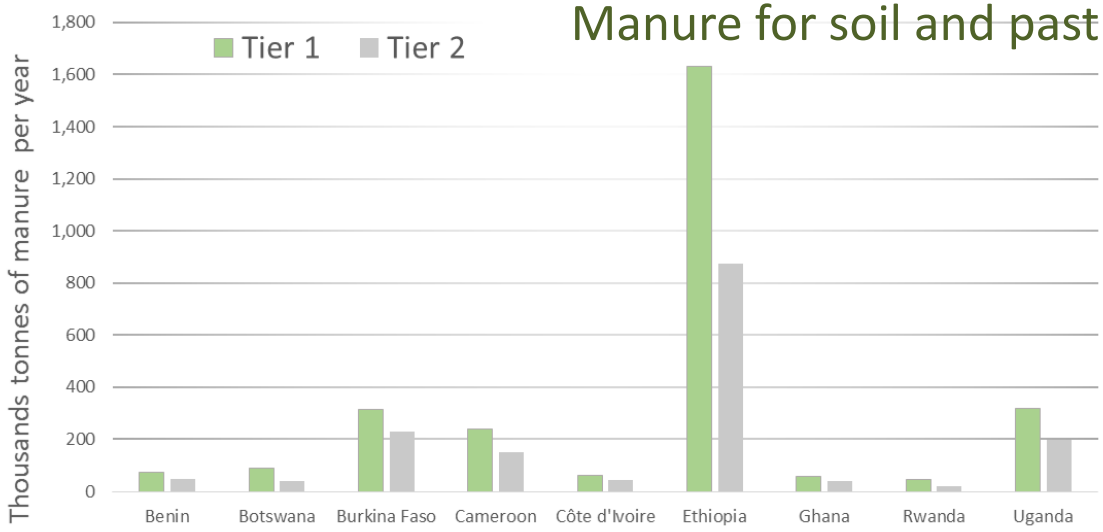
Total manure produced for soil and pasture applications

Share of manure applied to soils and left on pastures

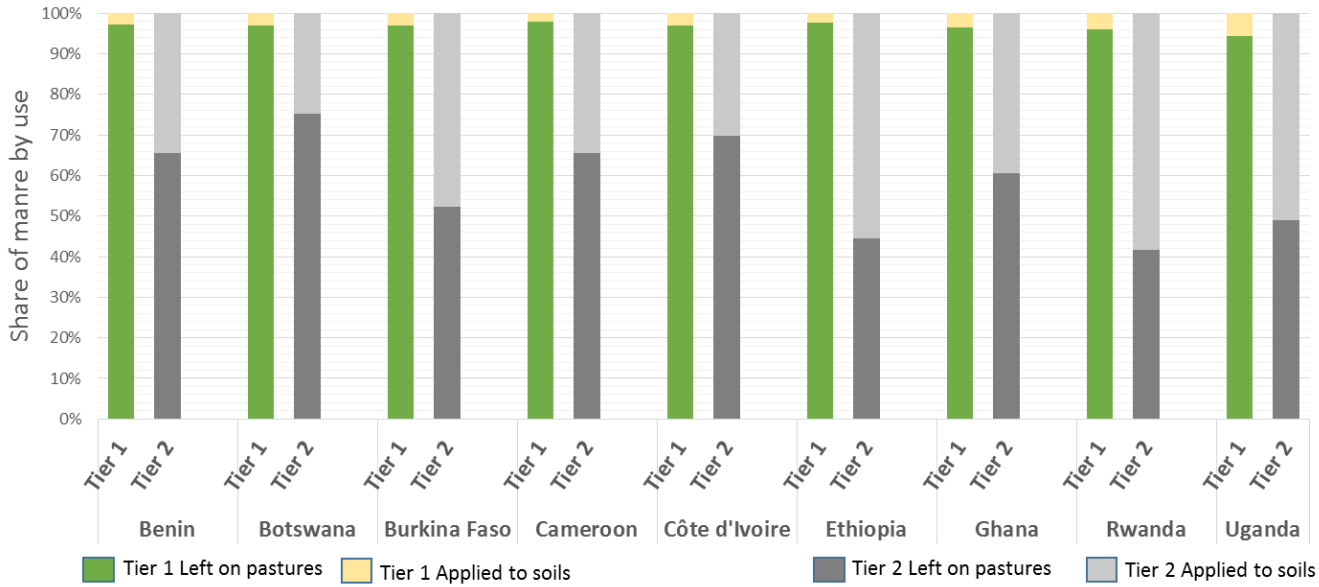
- ✓ Cattle
- ✓ Small ruminants
- ✓ Chicken
- ✓ Pigs

Results: both Tiers for cattle (*circa* year 2005)

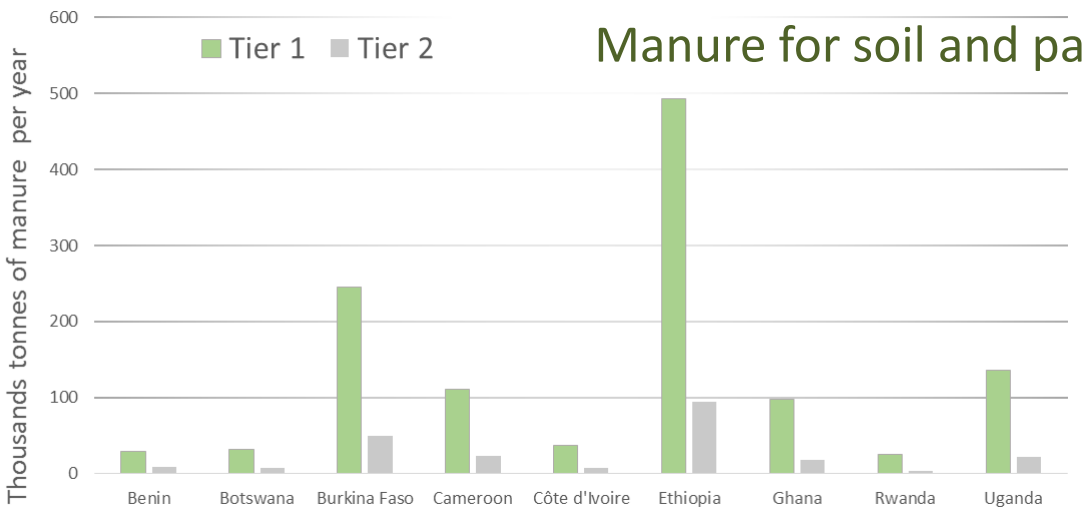
Manure for soil and pasture applications

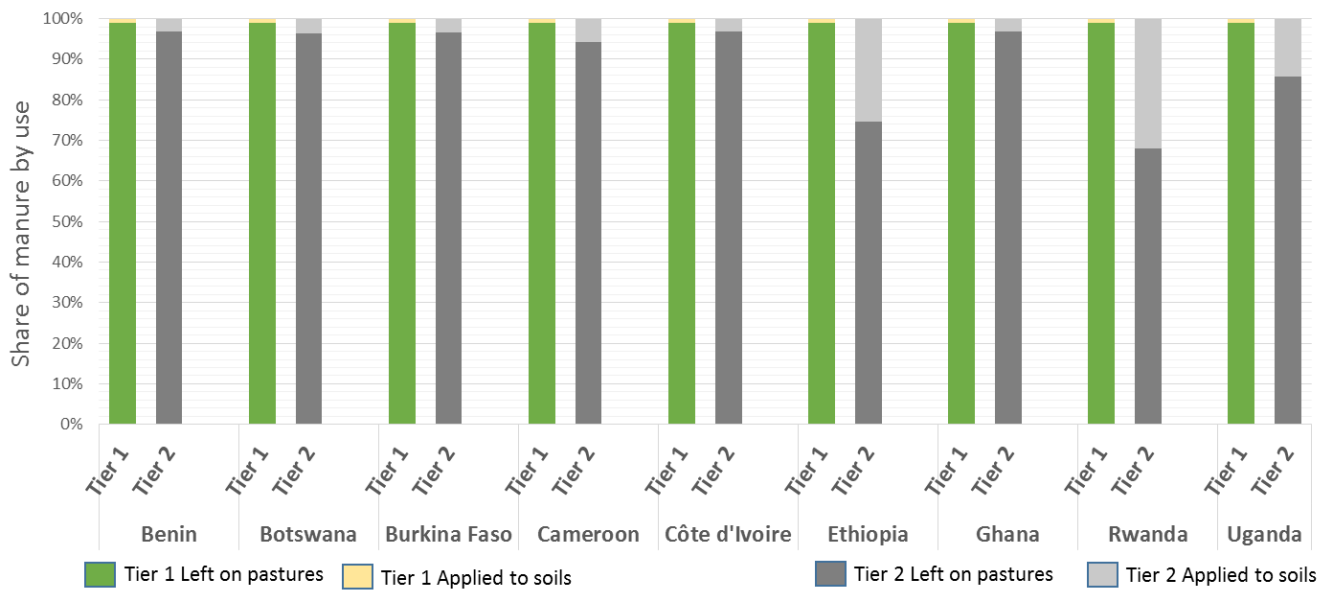


Share of manure by use in Tier 1 and 2



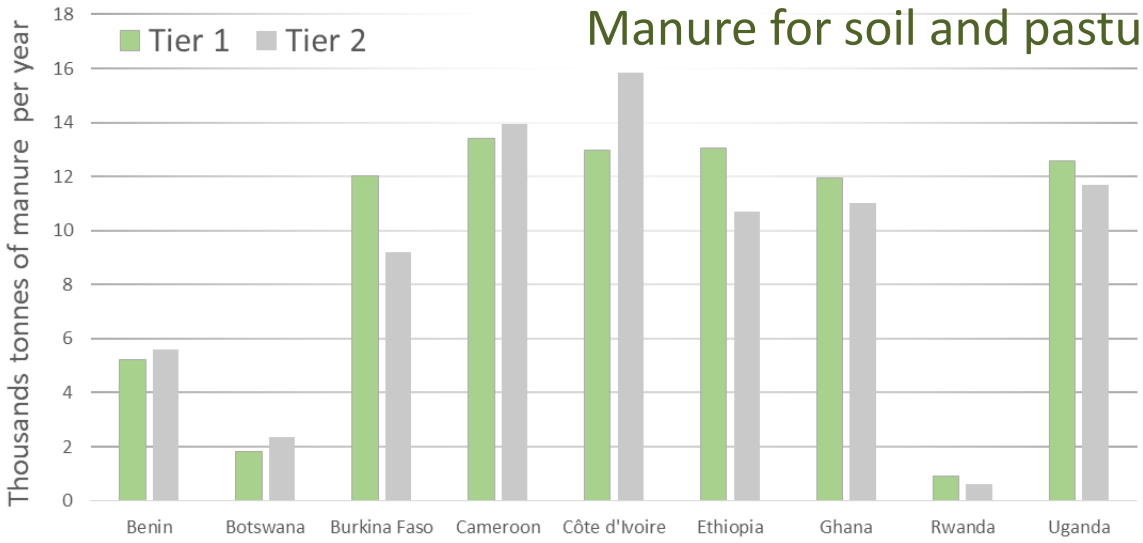
Results: both Tiers for small ruminants (*circa* year 2005)



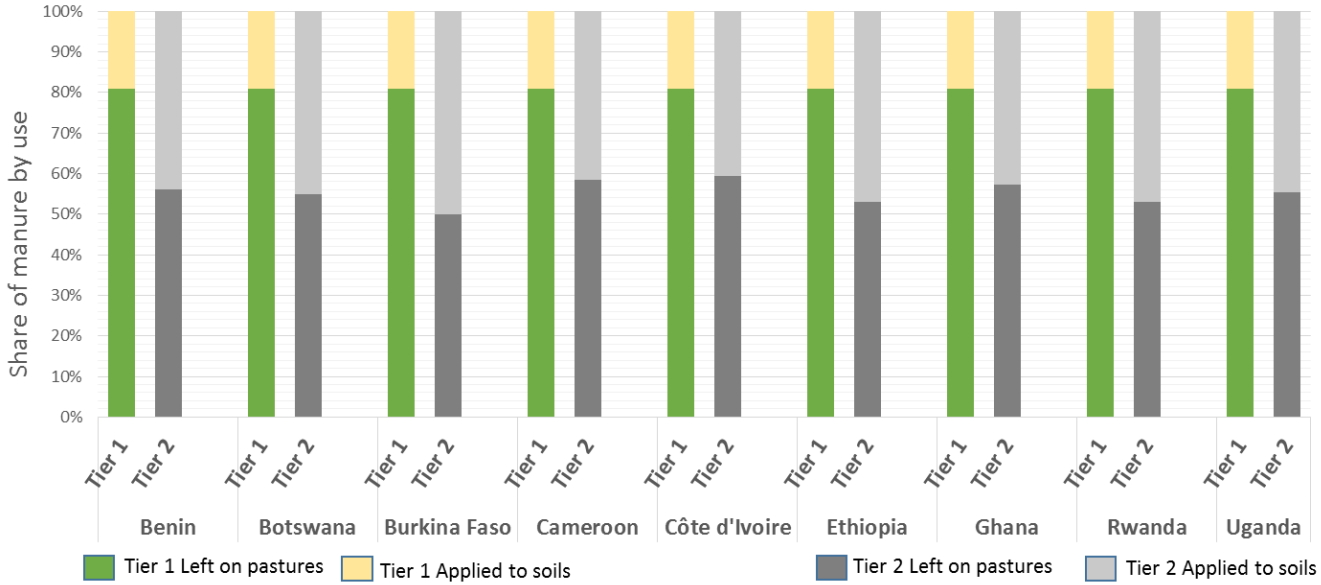


Results: both Tiers for chicken (*circa* year 2005)

Manure for soil and pasture applications

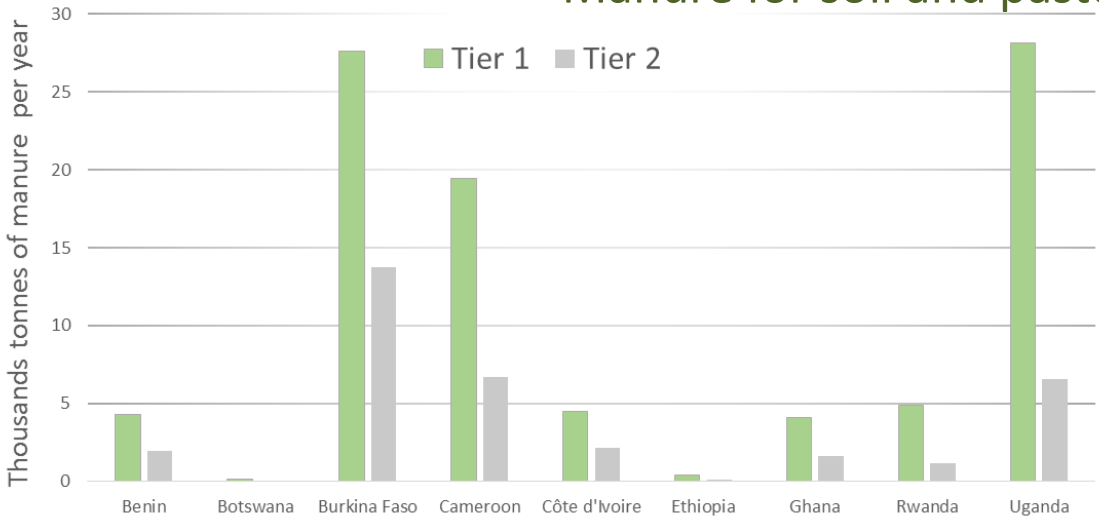


Share of manure by Tier and use

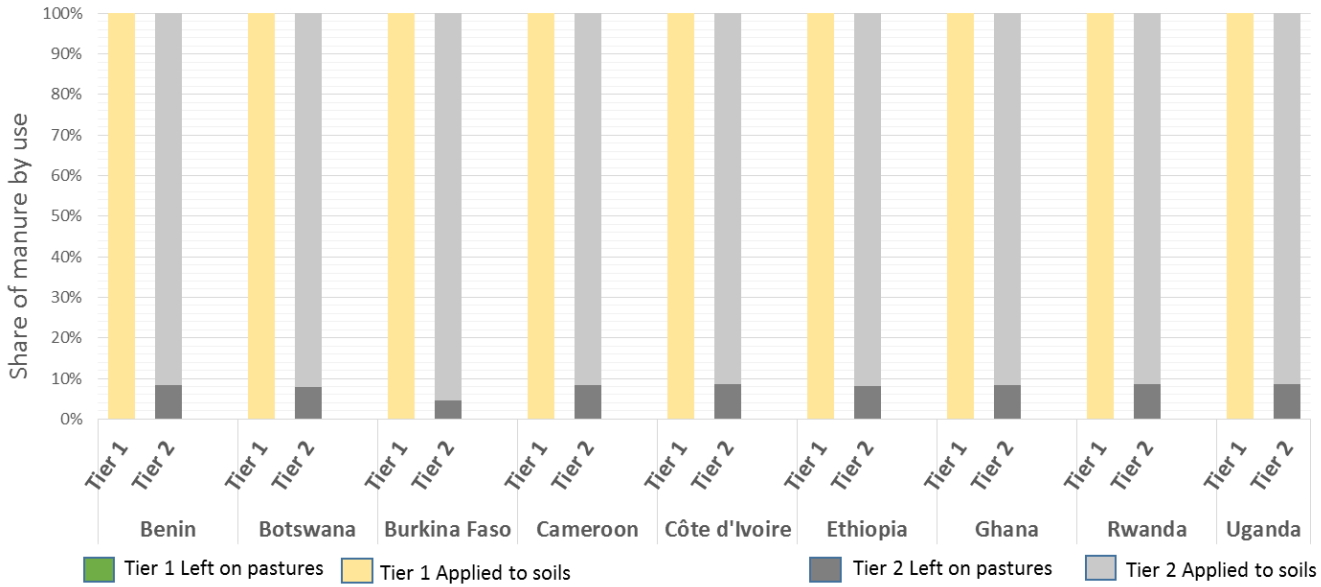


Results: both Tiers for pigs (*circa* year 2005)

Manure for soil and pasture applications



Share of manure by use in Tier 1 and 2



Conclusions

- ✓ Access to data
- ✓ Livestock dynamic sector need for a baseline
- ✓ Data only not sufficient – Institutional gaps and coordination also major constraints

Thank you!

http://www.fao.org/economic/ess/environment/en

Data analysis for methodological support

- ✓ AGA, AGP and ESS collaboration
- ✓ Tier 1 approach as baseline
- ✓ Tier 2 Modeling
- ✓ Report under preparation

Practical examples in SEEA – Agriculture accounts

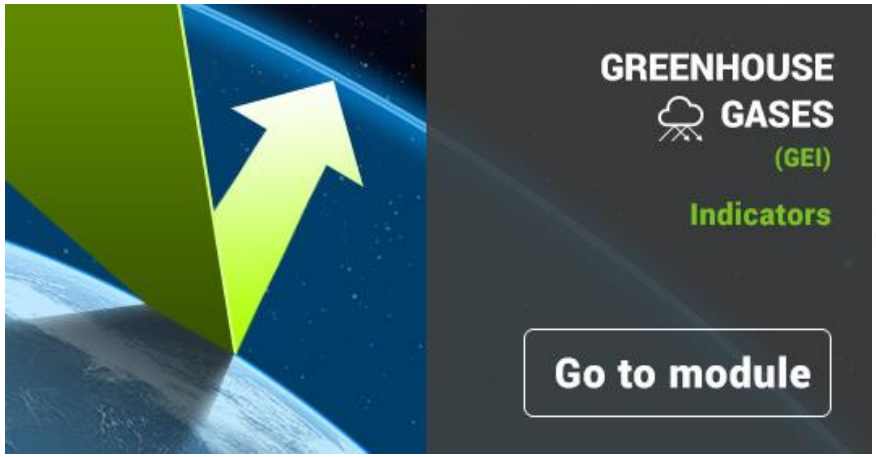
Physical flow accounts for fertilizers and nutrient flows (tonnes of nutrient equivalent)

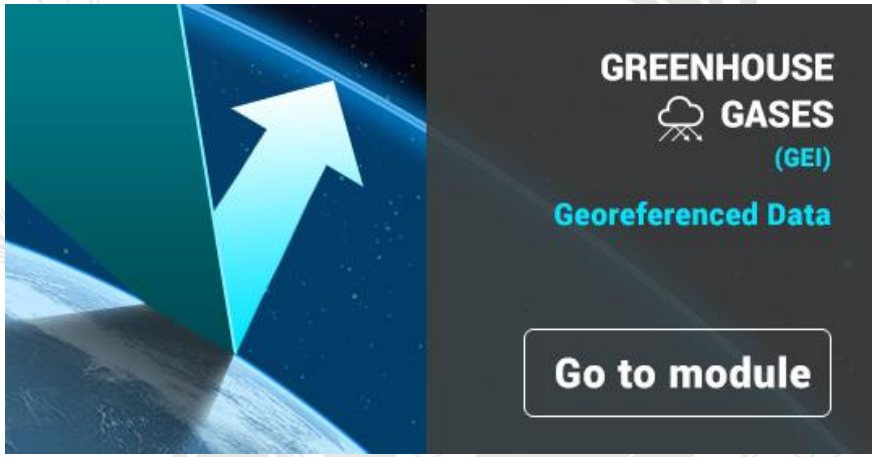
	Output	Imports	TOTAL SUPPLY	Intermediate consumption															Household final consumption	Changes in inventories		Exports	TOTAL USE
				Maize	Rice	Wheat	Palm oil	Sugar	Potatoes	Other food crops	Non-food crops	Livestock grazing	Other agriculture	Total agriculture	Forestry	Fisheries	Other industries	Total		Losses	Other changes		
Inorganic fertilizers																							
Nitrogen Fertilizers (N total nutrients)																							
Phostate Fertilizers (P_2O_5 total nutrients)																							
Potash Fertilizers (K_2O total nutrients)																							
Organic fertilizers																							
In situ sources of N																							
Urine/dung from grazing animals																							
Crop residues																							
Mineralisation of N with loss of C during land use change																							
Application of organic fertilizers (N total nutrients)																							
Collected manure																							
Compost																							
Sewerage sludge																							
Other																							

non-productive purpose: garden, use of manure as an energy source

quantity of fertilizer products, expressed in nutrient equivalent, lost during the year in storage and transport between production and final use. It does not include quantities applied to the soil but not taken up by plants or residual flows to the environment.

New Data Analysis Tools in FAOSTAT Emissions Database Test site





Per capita

Agro-meterology

Food and Agriculture Organization of the United Nations

FAOSTAT http://faostat3.fao.org/home/E

Yearly Questionnaires on fertilizers sent to member countries to collect information on:

- ✓ nutrient contents
- ✓ Production
- ✓ trade
- ✓ and the amount used for crop production

FAOSTAT http://faostat3.fao.org/home/E

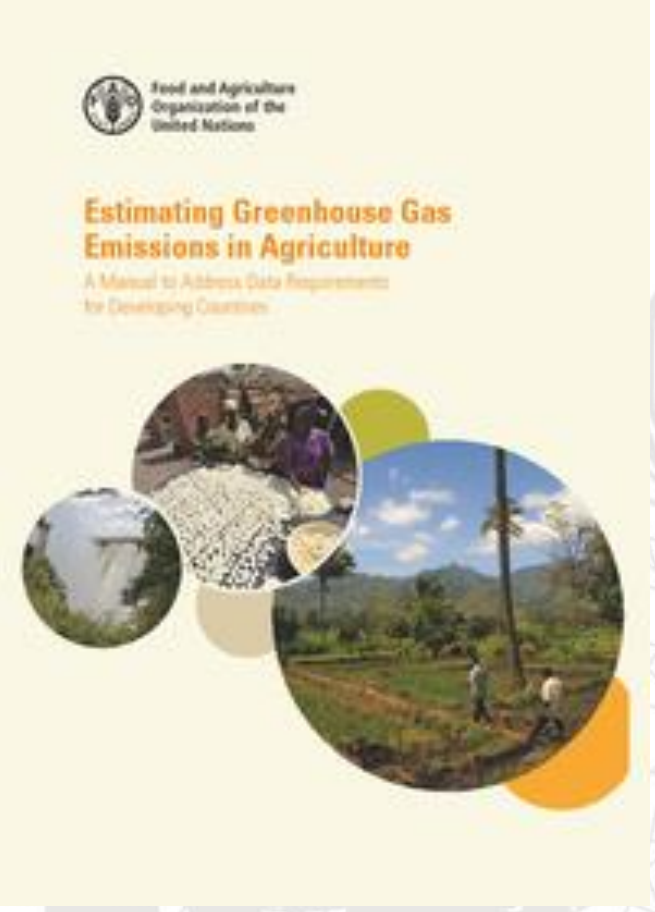
Information difficult to collect
Response rates for questionnaires

Region	Number of countries (a)	Number of questionnaires sent (a)	Response rate						
			2007	2008	2009	2010	2011	2012	2013
Eastern Africa	22	16	38%	31%	13%	31%	31%	31%	19%
Middle Africa	9	8	38%	13%	13%	25%	0%	0%	0%
Northern Africa	8	6	50%	50%	33%	33%	50%	50%	33%
Southern Africa	5	4	0%	25%	0%	25%	0%	25%	25%
Western Africa	17	16	50%	19%	25%	19%	25%	19%	38%
Africa, Total	61	50	40%	26%	18%	26%	24%	24%	24%
WORLD	227	204	63%	48%	44%	46%	44%	46%	47%

FAOSTAT http://faostat3.fao.org/home/E

Database on Emissions (available in FAOSTAT since 2012)

Partially addresses these shortcomings



Addressing different data analysis needs:

1. National, Regional and Global Assessments: Facilitate regional comparisons and trend analysis for AFOLU
2. Fill data gaps and QA/QC procedures: Provide a reference, Tier 1 data framework for analysis of AFOLU GHG trends for all countries–EU 28 QA/QC in 2014 using FAOSTAT Emissions data
3. Develop Indicators: Derive complex GHG indexes useful for analysis and policy support
4. Access geo-referenced data: Move beyond nationally aggregated statistics for the land use sector