

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***



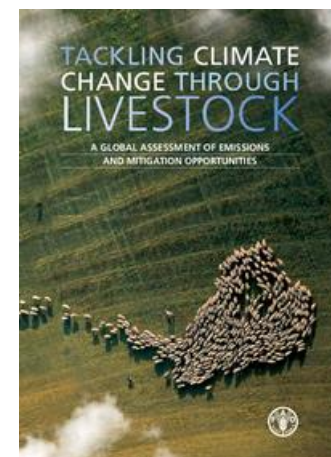
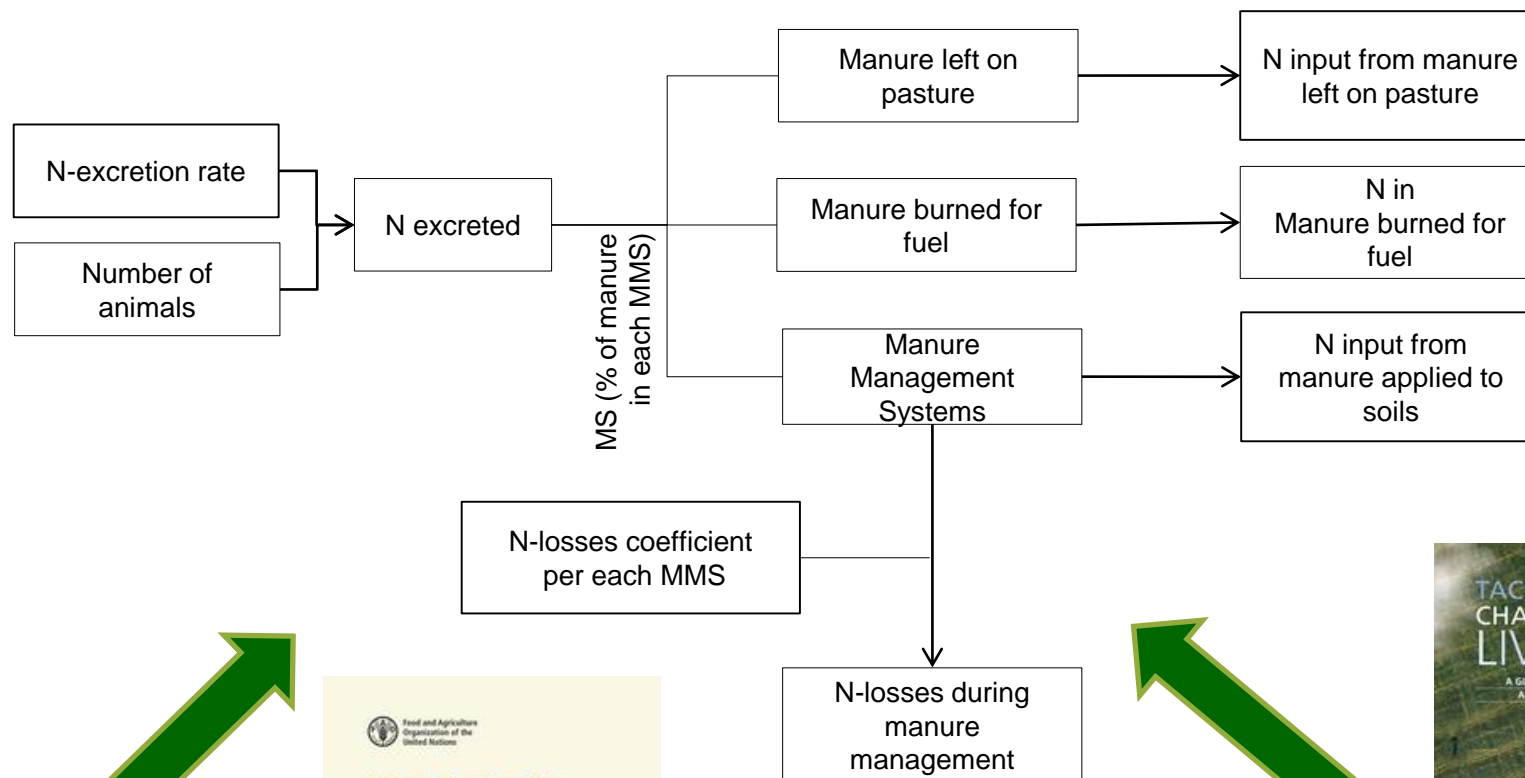
Food and Agriculture Organization
of the United Nations

Summary

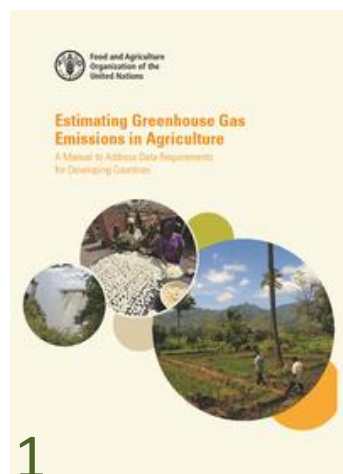
- Specific Data components
- FAO contributions:
 - FAOSTAT
 - GLEAM
 - New Work on linking FAOSTAT and GLEAM



Generic Data and Modeling Framework for Manure N



GLEAM
Tier 2/3



FAOSTAT
IPCC 2006
Reference Tier 1

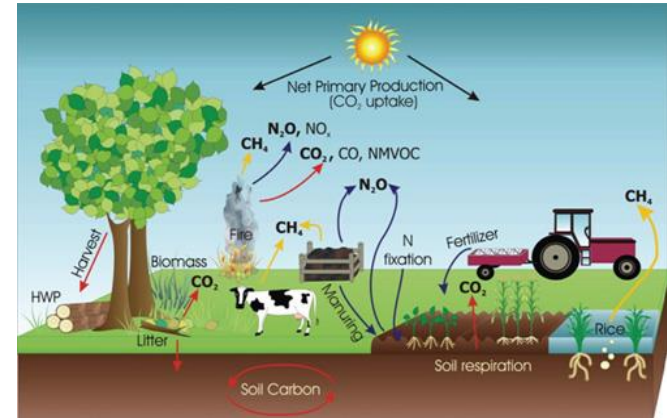
Manure Data within FAOSTAT (Emissions Database):



& geo-reference data



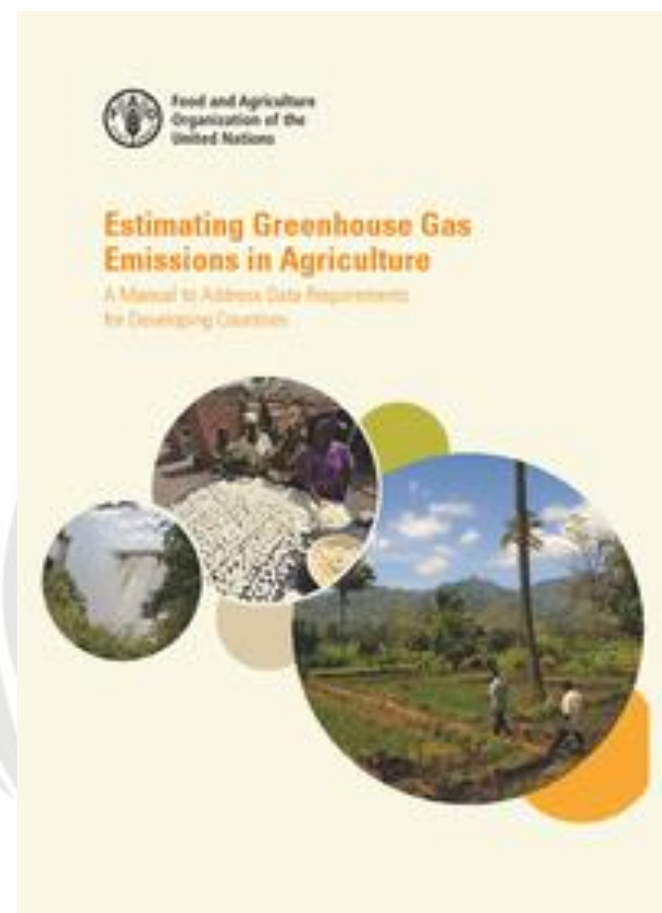
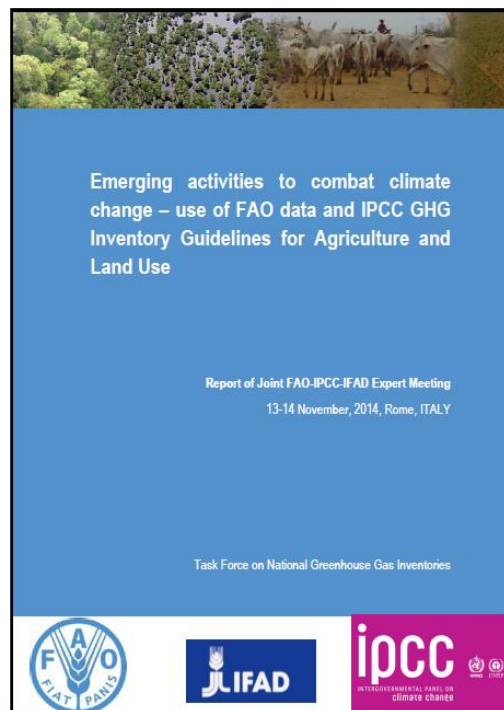
IPCC 2006 Guidelines



Food and Agriculture Organization
of the United Nations

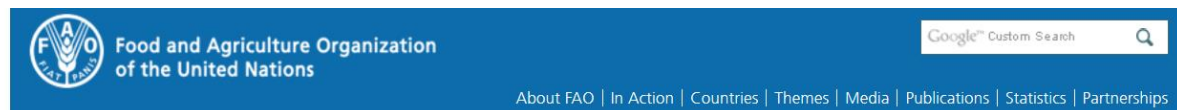
FAOSTAT <http://faostat3.fao.org/home/E>

Database on Emissions (available in FAOSTAT since 2012)




Food and Agriculture Organization
of the United Nations

Global Livestock Environment Assessment Model (GLEAM)




Global Livestock Environmental Assessment Model (GLEAM)

	Model description	Results	Resources	Team	FAQs
---	-------------------	---------	-----------	------	------

What is GLEAM?

The Global Livestock Environmental Assessment Model is a modelling framework that simulates the environmental impacts of the livestock sector. It represents the bio-physical processes and activities along livestock production chains under a life cycle assessment approach.

The aim of GLEAM is to identify harmful undesired environmental side effects and to contribute to the assessment of adaptation and mitigation scenarios to move towards a more sustainable livestock sector.



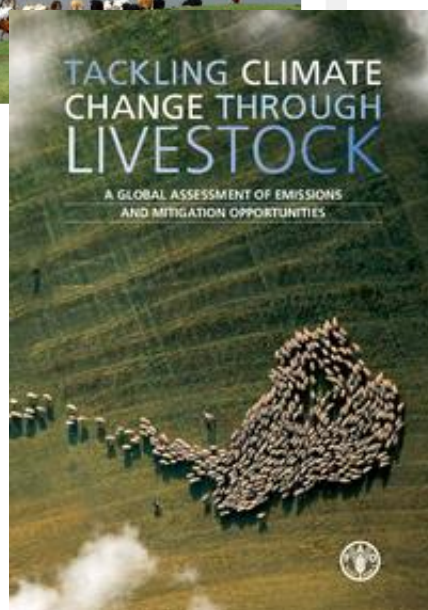
GLEAM model in brief

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.

Greenhouse gas emissions from pig and chicken supply chains
A global life cycle assessment

Greenhouse gas emissions from ruminant supply chains
A global life cycle assessment



Greenhouse Gas Emissions from the Dairy Sector
A Life Cycle Assessment

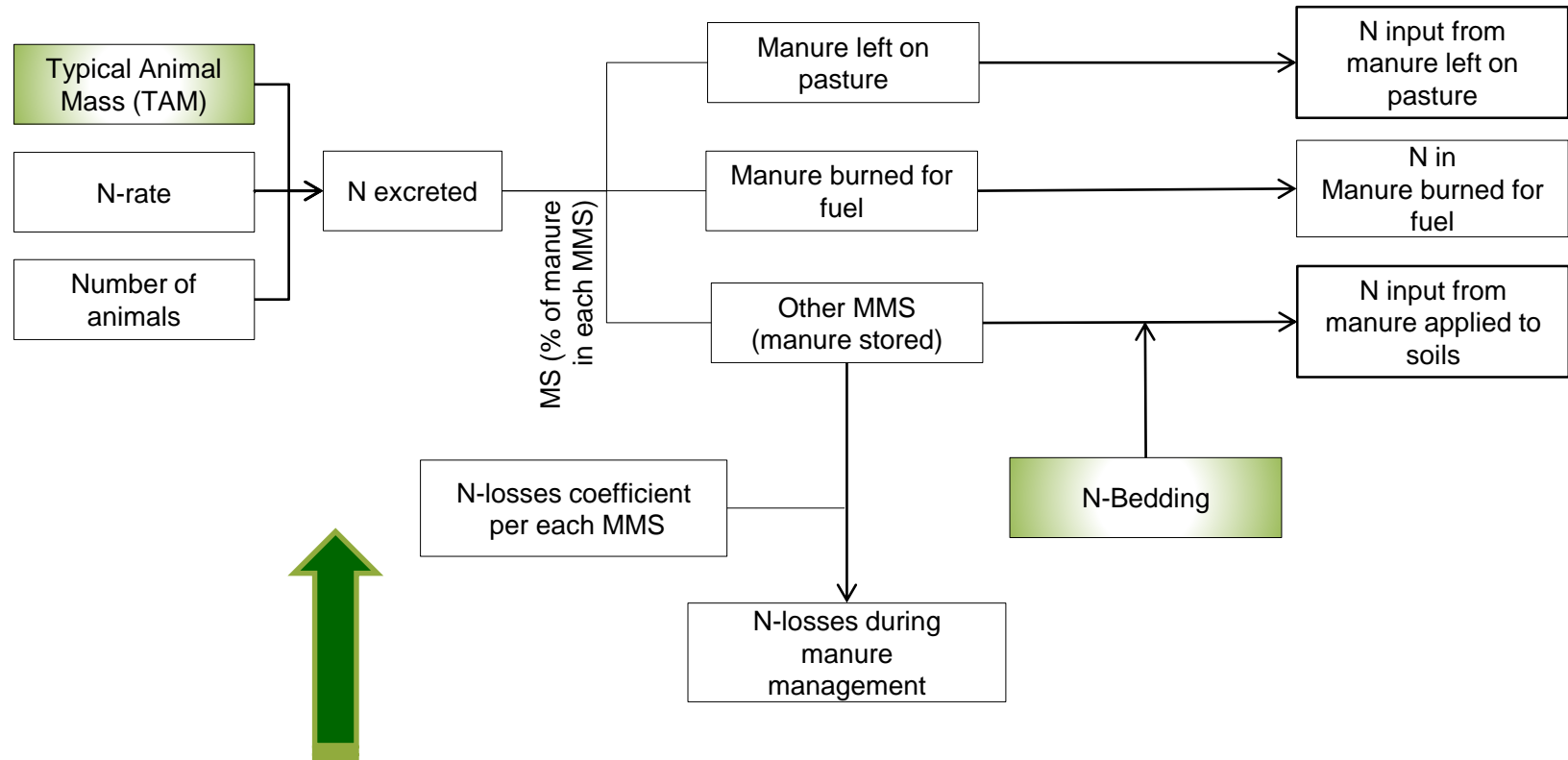
FAO Animal Production and Health division

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

Global Livestock Environment Assessment Model (GLEAM)

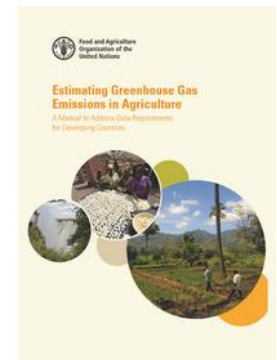
- **Modeling framework that simulates the environmental impacts of the livestock sector**
- **Develop to assess livestock's impacts**
- **Support mitigation and adaptation options at various scales**
- **Assess specific impacts of key stages along the livestock supply chains:**
 - **feed production, 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 CH₄ and N₂O
- N losses during manure management

➤ Outputs

- N content in managed manure
- Emissions : CH₄ and N₂O and CO_{2eq}

FAOSTAT Domains

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

Filters / Emissions - Agriculture / Manure Management

Countries Regions Special Groups

Afghanistan
Albania
Algeria
American Samoa
Andorra

☒ SELECT ALL ☐ CLEAR ALL

Elements

Manure (N content)
Implied emission factor for CH₄
Implied emission factor for N₂O
Emissions (CH₄)
Emissions (CO_{2eq}) from CH₄

☒ SELECT ALL ☐ CLEAR ALL

Items Items Aggregated

Mules
Sheep
Swine, breeding
Swine, market
Turkeys

☒ SELECT ALL ☐ CLEAR ALL

Years Year Projections

2012
2011
2010
2009
2008

☒ SELECT ALL ☐ CLEAR ALL

Summary

ELEMENTS Manure (N content)

ITEMS Asses Buffaloes Camels Cattle, dairy Cattle, non-dairy Chickens, broilers Chickens, layers Ducks Goats H

YEARS 2012

DISPLAY OUTPUT AS ☒ TABLE ☐ PIVOT

Output Preview (first 50 rows only)

Domain	Country	Element	Item	Year	Unit	Value	Flag	Flag Description
Manure Management	World	Manure (N content) (Manure management)	Buffaloes	2012	Kg	2158092857.50		

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





Download

FAOSTAT Domains

- ▶ Food Security
- ▼ Production
 - Crops
 - 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>



Food and Agriculture
Organization of the
United Nations

**Estimating Greenhouse Gas
Emissions in Agriculture**
A Manual to Address Data Requirements
for Developing Countries



FAOSTAT Manure applied to soils

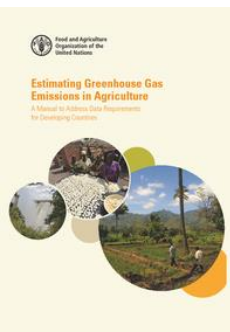
➤ Activity data: total amount of manure (in kg of N yr⁻¹ that is applied to soil)

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)



Download

FAOSTAT Domains

- ▶ 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
 - 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	Elements
Afghanistan Albania Algeria American Samoa Andorra			Manure (N content) Implied emission factor for N2O Direct emissions (N2O) Direct emissions (CO2eq) Indirect emissions (N2O)
<input checked="" type="checkbox"/> SELECT ALL	<input type="checkbox"/> CLEAR ALL		<input checked="" type="checkbox"/> SELECT ALL

Items	Items Aggregated	Years	Year Projections
Asses Buffaloes Camels Cattle, dairy Cattle, non-dairy		2012 2011 2010 2009 2008	
<input checked="" type="checkbox"/> SELECT ALL	<input type="checkbox"/> CLEAR ALL	<input checked="" type="checkbox"/> SELECT ALL	<input type="checkbox"/> CLEAR ALL

Summary

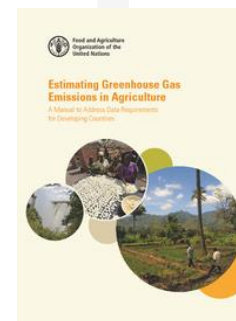
Please use the selectors above to filter your query. Your selection will be displayed in the area below and it can be edited at any time.

 DISPLAY OUTPUT AS ☒ TABLE ☐ PIVOT

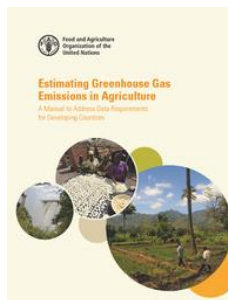
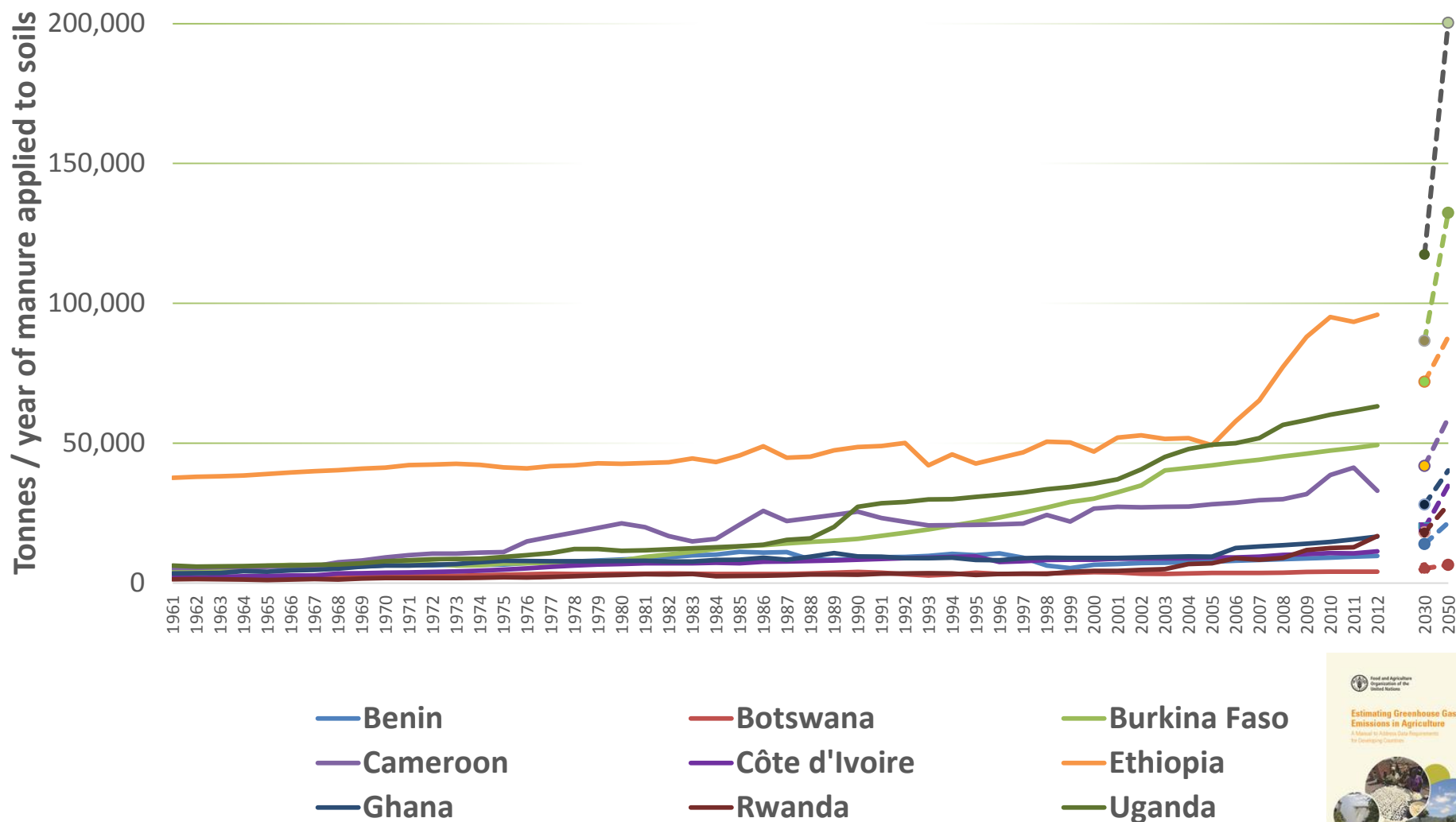
[PREVIEW](#)
[CSV](#)
[EXCEL](#)

Relevant domains under Emissions from
Agriculture: Manure Applied to Soils

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

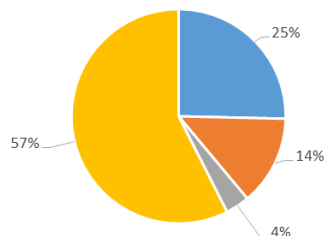


FAOSTAT 1961 – 2012 Manure applied to soils

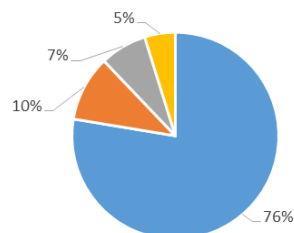


Livestock species contribution for manure applied to soils

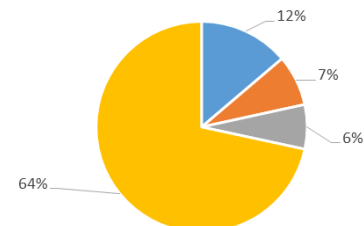
Benin - Applied to soils Tier 1



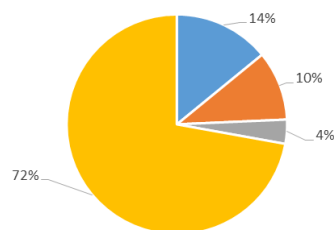
Botswana - Applied to soil Tier 1



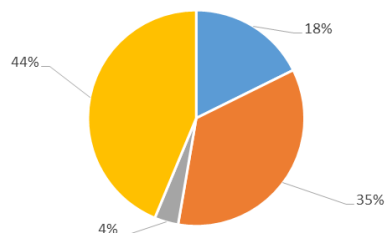
Burkina Faso -Applied to soil Tier 1



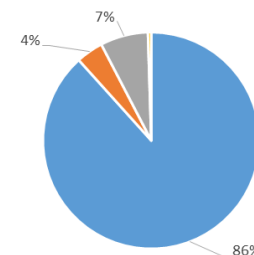
Cameroon - Applied to soils Tier 1



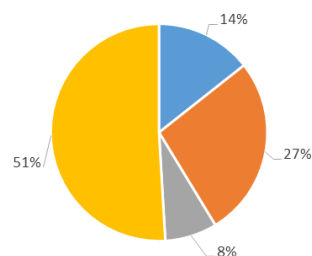
Côte d'Ivoire - Applied to soils Tier 1



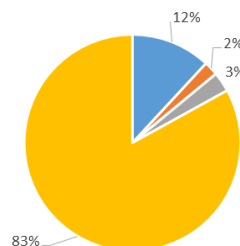
Ethiopia - Applied to soils Tier 1



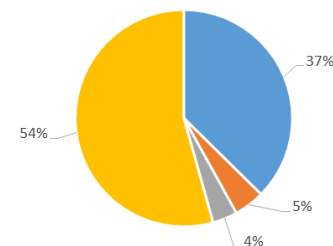
Ghana - Applied to soils Tier 1



Rwanda - Applied to soil Tier 1



Uganda - Applied to soil Tier 1



FAOSTAT Manure left on pastures

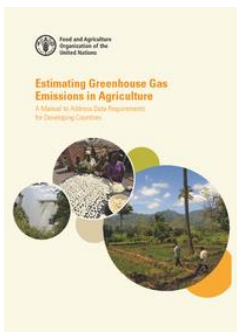
- Activity data: total amount of manure (in kg of N yr⁻¹ that is left on pastures)

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)





Download

FAOSTAT Domains

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

Filters / Emissions - Agriculture / Manure left on Pasture

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

Q PREVIEW

CSV

EXCEL

Relevant domains under Emissions from
Agriculture: Manure Left on Pastures

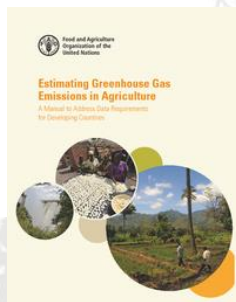
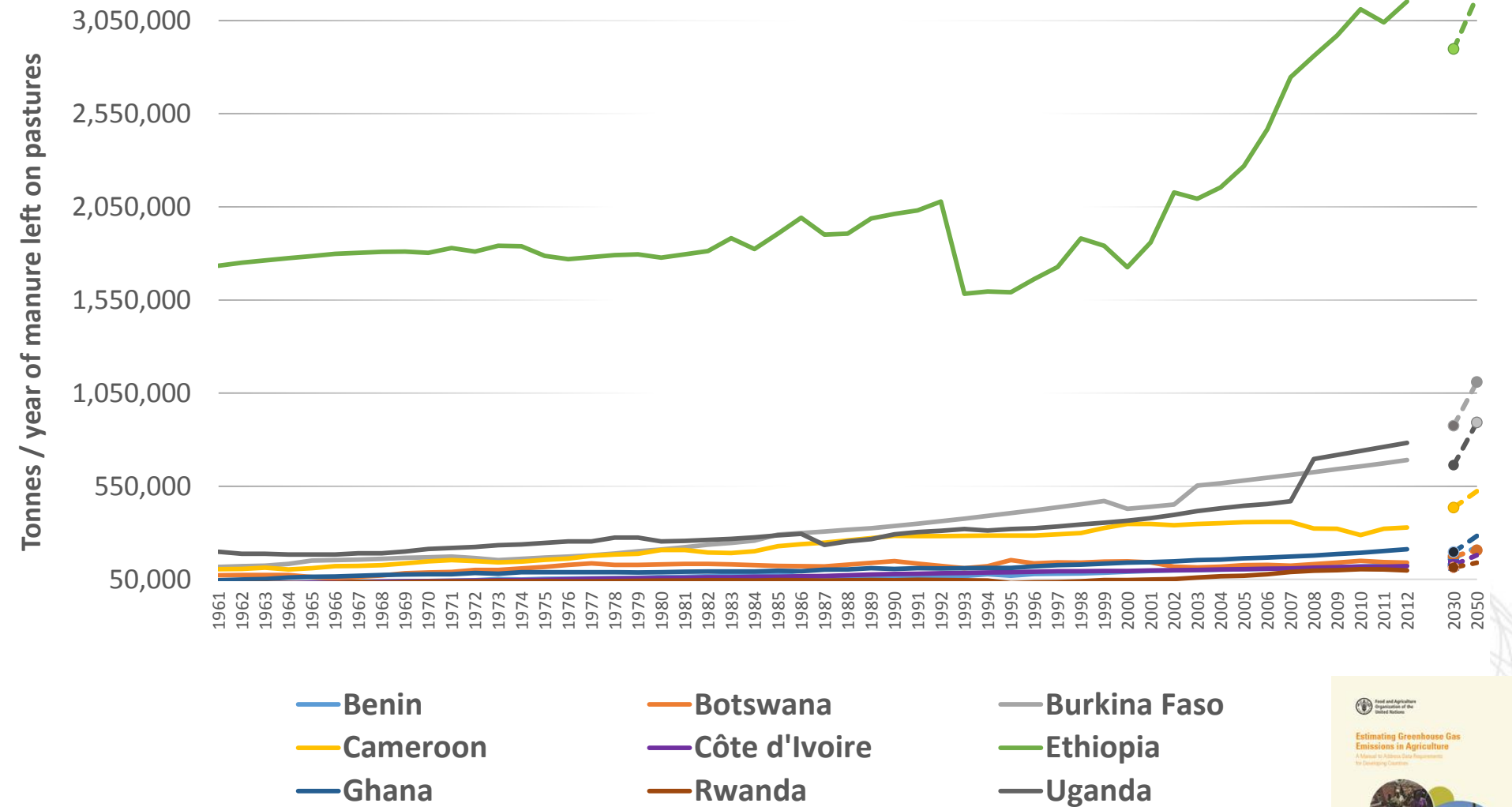
<http://faostat3.fao.org/download/G1/GP/E>



Estimating Greenhouse Gas
Emissions in Agriculture
A Manual to Address Data Requirements
for Developing Countries

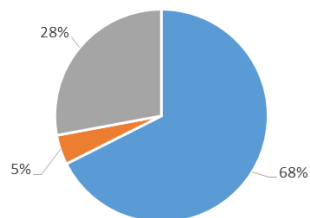


FAOSTAT 1961 – 2012 Left on pastures

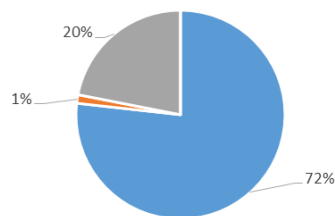


Livestock species contribution for manure left on pastures

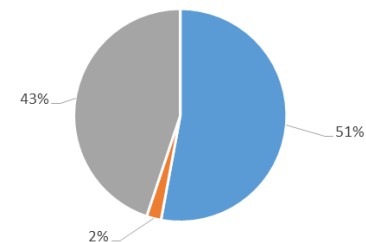
Benin - Left on Pasture Tier 1



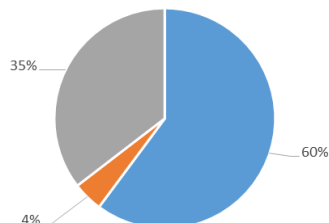
Botswana - Left on pasture Tier 1



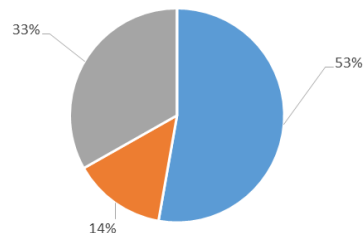
Burkina Faso - Left on pasture Tier 1



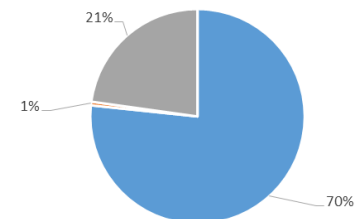
Cameroon - Left on pasture Tier 1



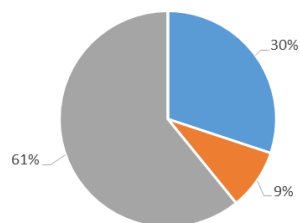
Côte d'Ivoire - Left on pasture Tier 1



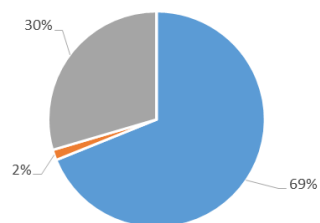
Ethiopia - Left on pasture Tier 1



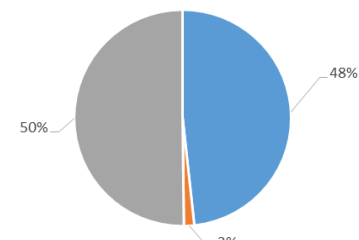
Ghana - Left on pasture Tier 1



Uganda - Applied to soil Tier 1



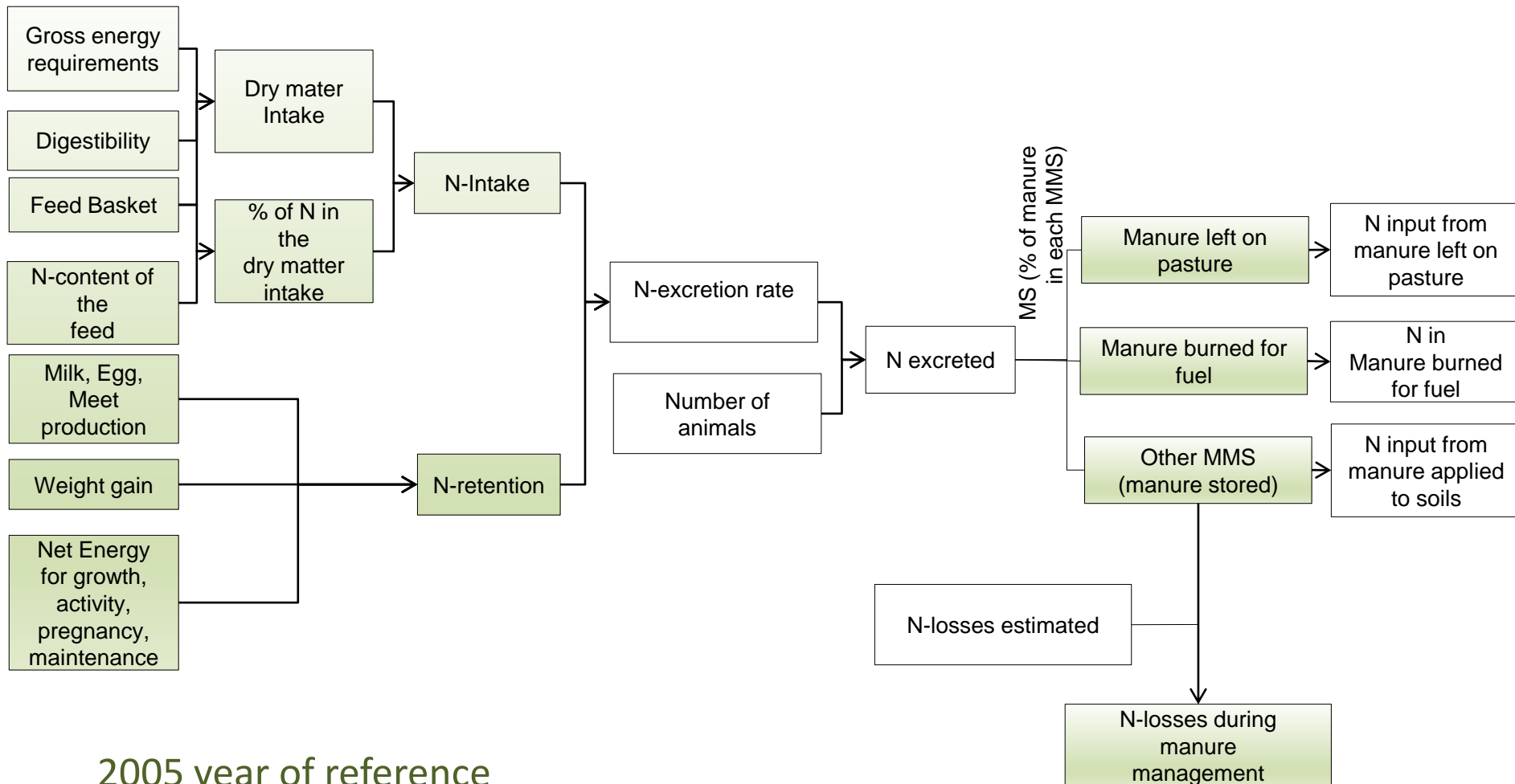
Rwanda - Applied to soil Tier 1



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



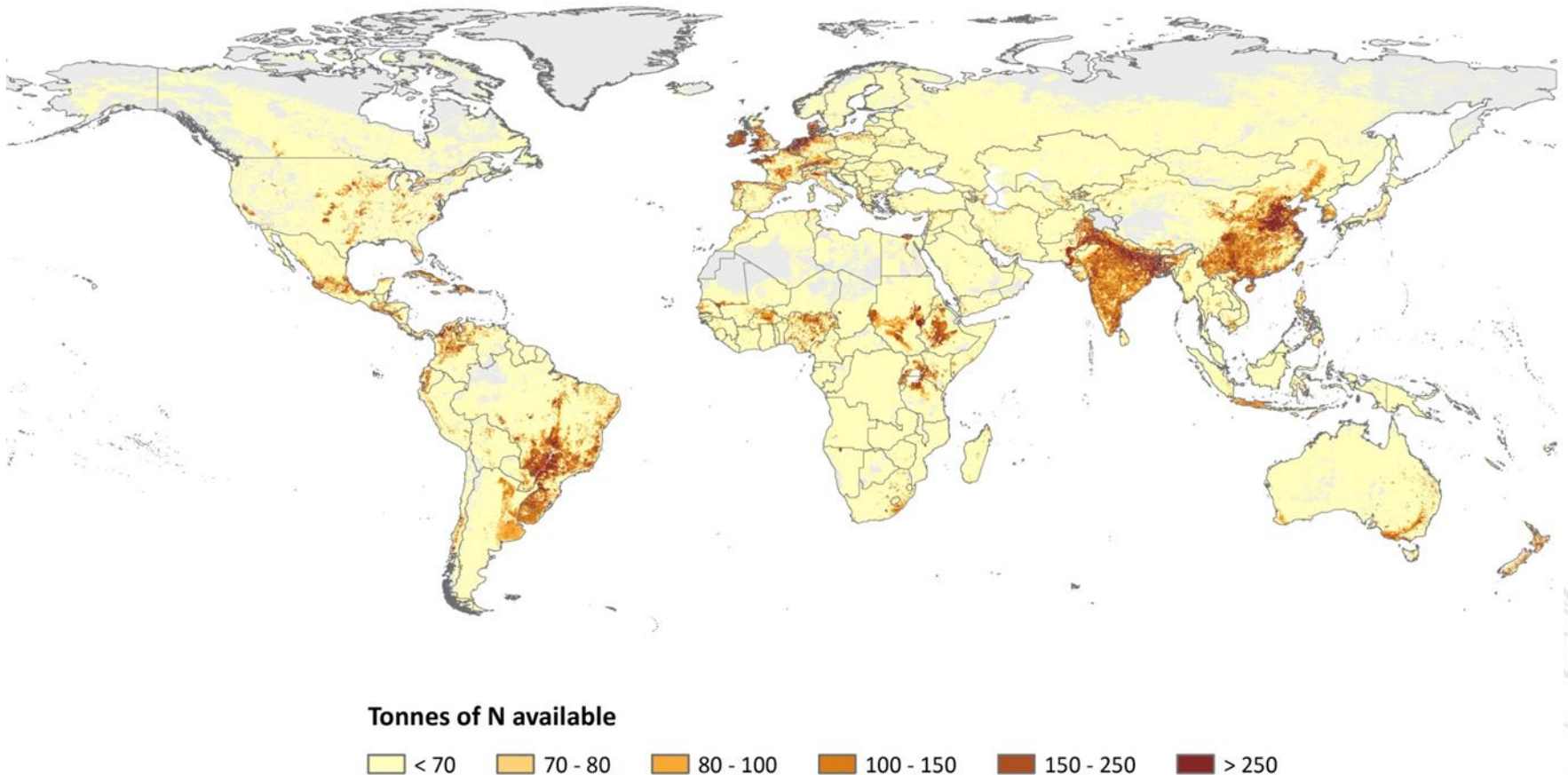
2005 year of reference
A Tier 2 approach

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







Manure Knowledge Kiosk

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

<http://www.manurekiosk.org/>

**GLOBAL AGENDA FOR SUSTAINABLE LIVESTOCK**

HOMEABOUT AGENDAACTION AREASNEWSEVENTSPARTNERSCONTACT



WASTE TO WORTH

Manure Knowledge Kiosk

- > About the LMMC project
- > News Archive
- > Events
- > From the Field

Lessons Learned

- > Introduction
- > Key Findings
- > Manure Policies
- > Enabling Environment
- > Manure Management Practices

Services and tools

- > Library
- > Livestock GEO Wiki
- > Linkages
- > Expert directory

Pilots

- > Opportunities for Practice

THE MANURE KNOWLEDGE KIOSK

The Manure Knowledge Kiosk is a platform for knowledge exchange, outreach and capacity building on integrated manure management. The kiosk is supported by the **Climate and Clean Air Coalition (CCAC)** as a tool of the Livestock and Manure Management Component of the CCACs Agriculture Initiative.

The kiosk provides the resources, knowledge and connections to help the global livestock sector turn integrated manure management opportunities and ideas into **practice change**. Manure management practices vary widely according to geographic region, socio-economic conditions, and agricultural practices. As a result policies, technologies and institutional arrangements needed to catalyse practice change will differ. To address these differences the Manure Knowledge Kiosk operates out of **regional centres** focusing on South and East Asia, Sub-Saharan Africa and Central and South America respectively.

What is manure worth?

Good manure management starts with recognizing and understanding the value of manure as a resource. Livestock manure represents a valuable resource that, if used appropriately provides multiple benefits. Manure contains the undigested fraction of the organic matter in the livestock diet. It contains i.e nitrogen (N), phosphorus (P), potassium (K), and sulphur (S) which are essential for plant growth. Most of the nutrients in livestock diets is excreted in dung and urine; generally more than 70% of dietary nitrogen and more than 65% of dietary phosphorus. The map illustrates on a global scale how much of the nitrogen intake is retained in the animal products, implicitly this also indicates the fraction that is excreted. **[read more]**

Sign up to our News digest

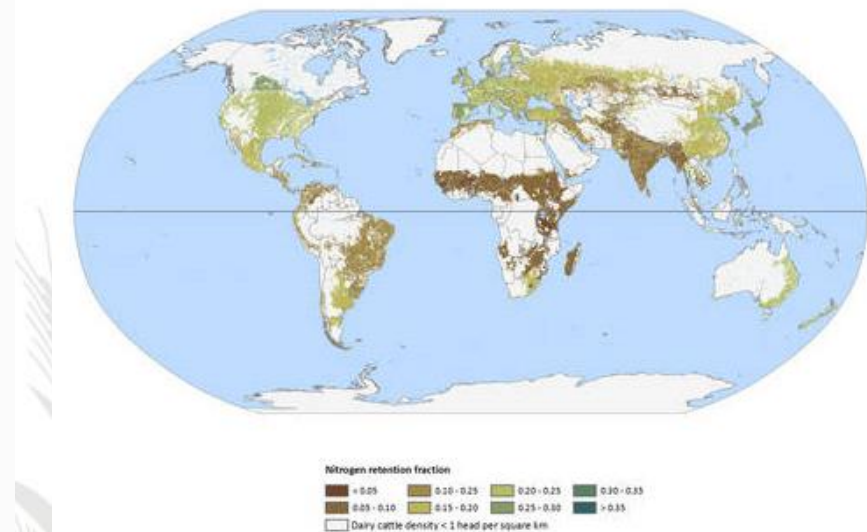
SUBSCRIBE

EVENTS

- 18-20 November, 2015
European Microfinance Platform Conference 2015
Luxembourg
- 4 December, 2015
World Soil Day
Rome, Italy
- 7-8 December, 2015
Sustainable Innovation Forum (SIF15) during COP21
Paris, France

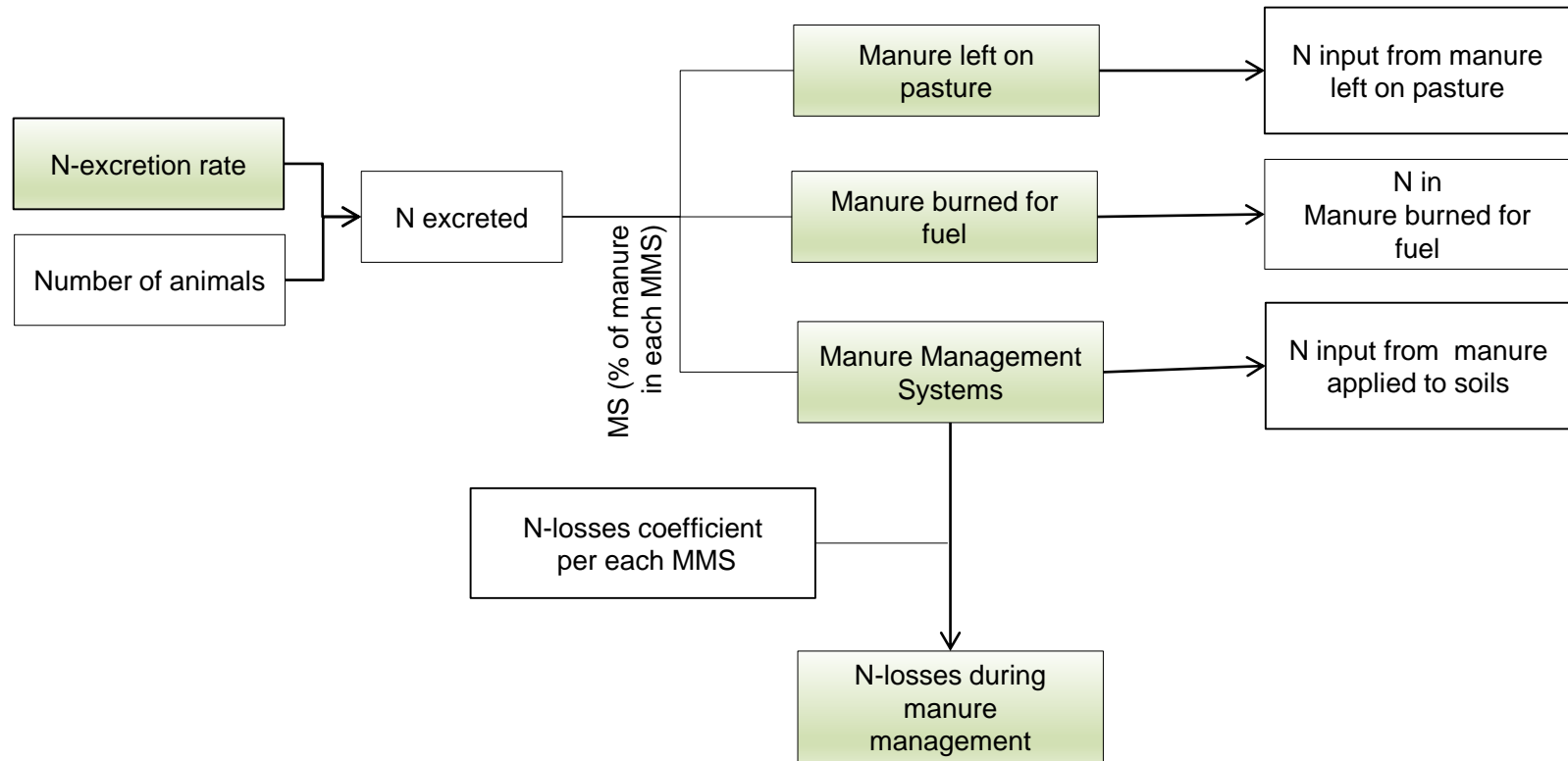
NEWS

- First draft national policy and action plan for integrated manure management completed
- Latin America stakeholders start manure management network
- Sustainable waste management: know what you don't know



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
		<i>kg N per animal per year</i>				
	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

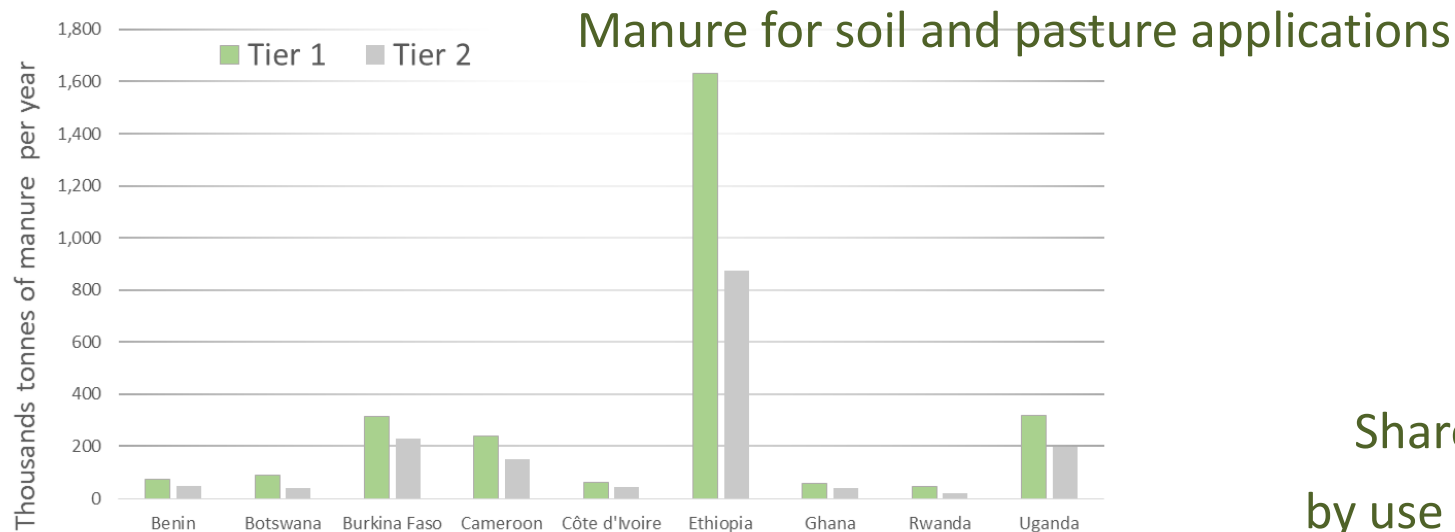
Analysis across Tier Approaches

Total manure produced for soil and pasture applications
Share of manure applied to soils and left on pastures

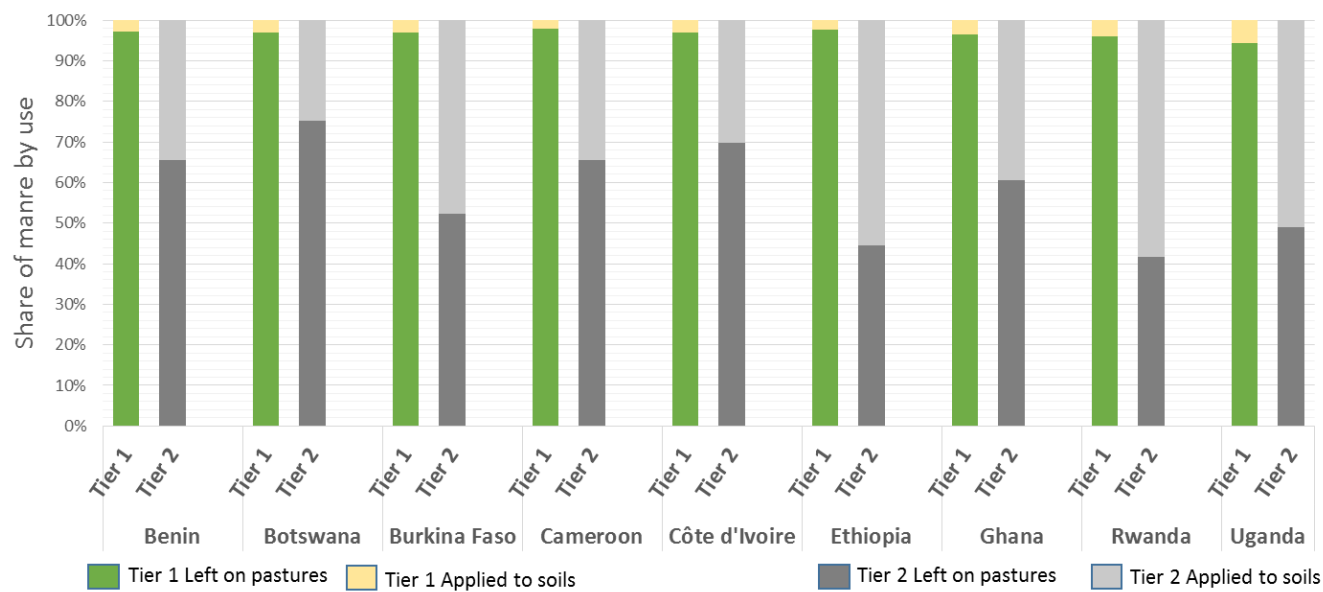
- ✓ Cattle
- ✓ Small ruminants
- ✓ Chicken
- ✓ Pigs



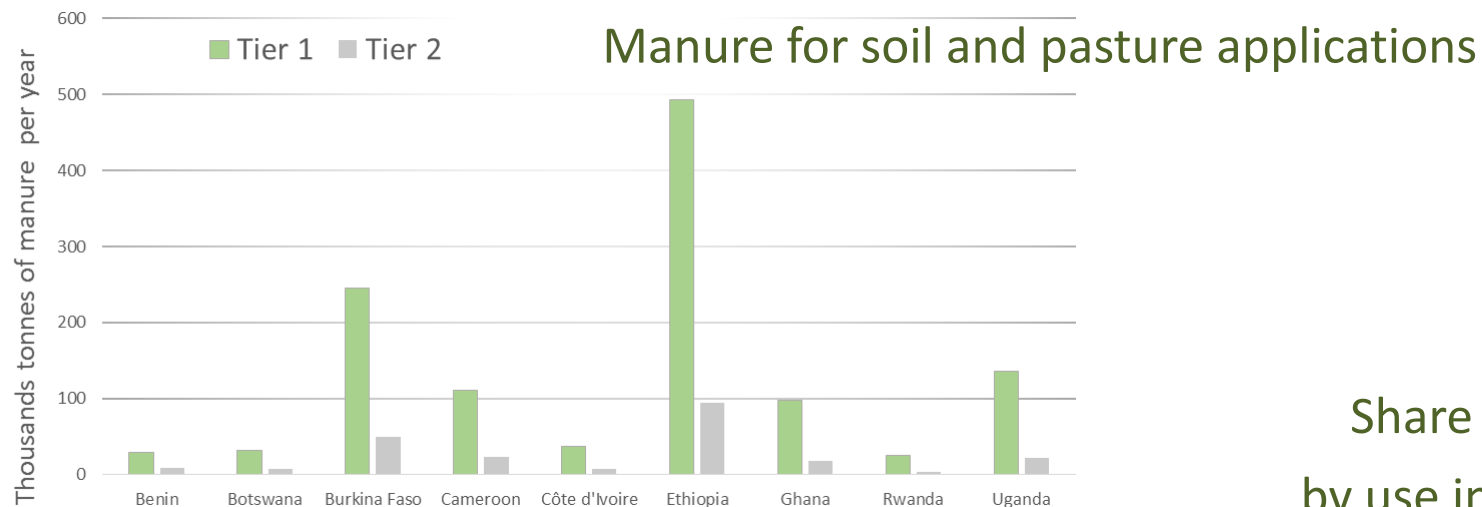
Results: both Tiers for cattle (*circa* year 2005)



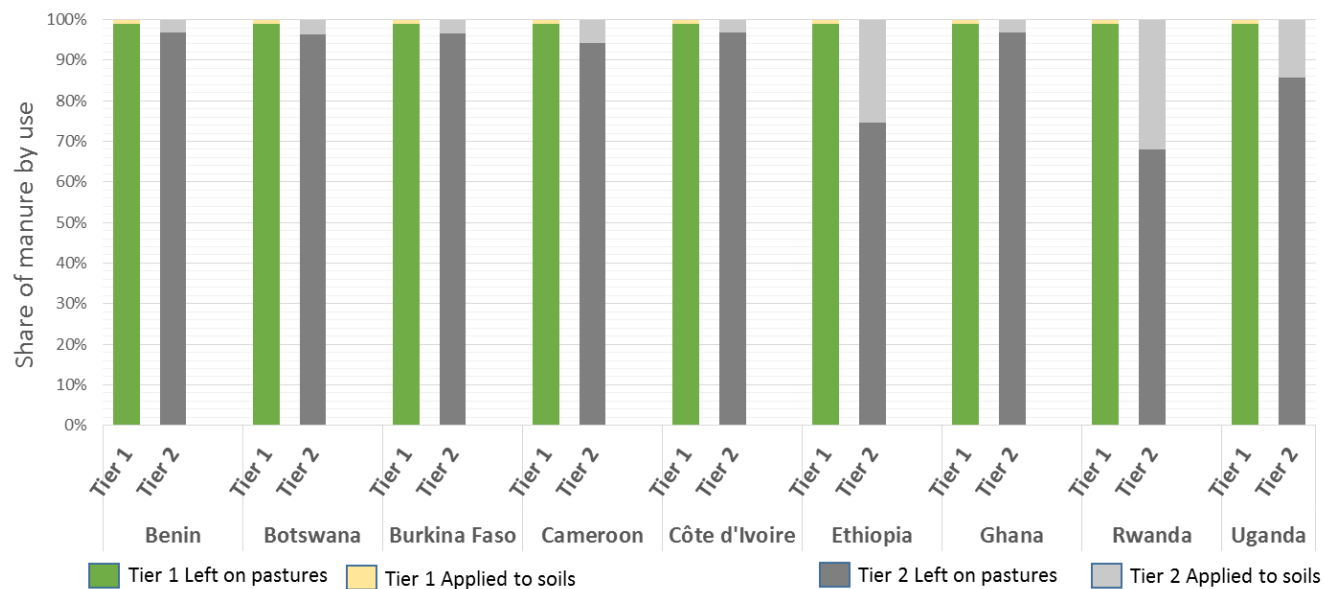
Share of manure by use in Tier 1 and 2



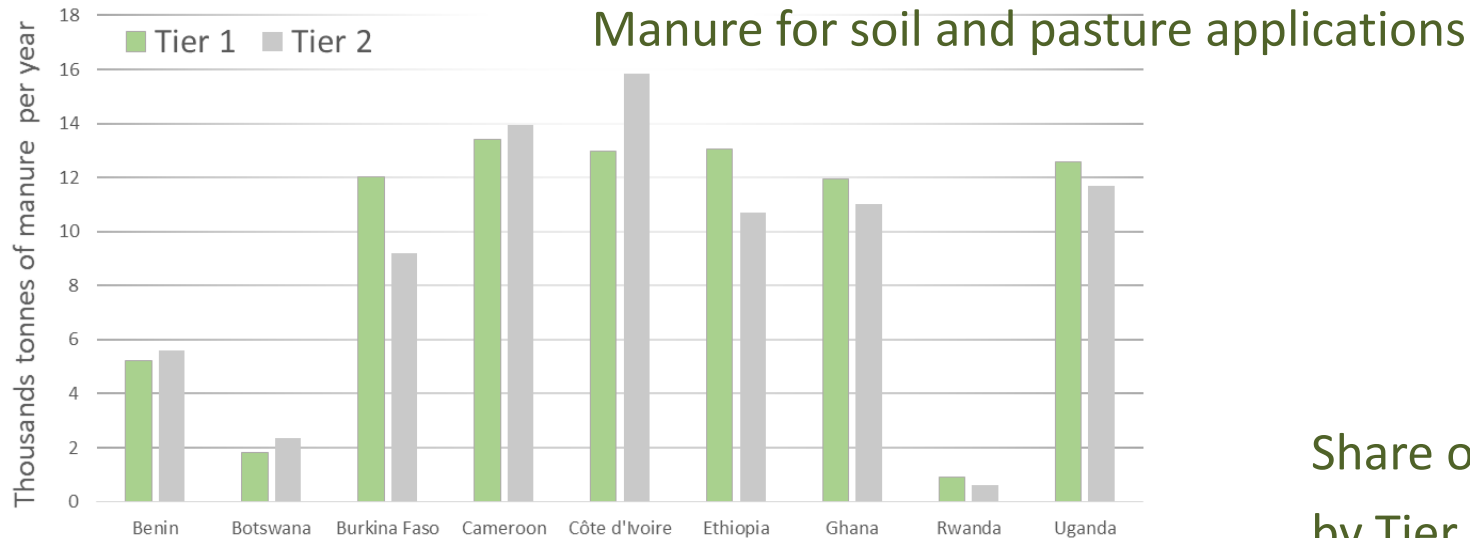
Results: both Tiers for small ruminants (*circa* year 2005)



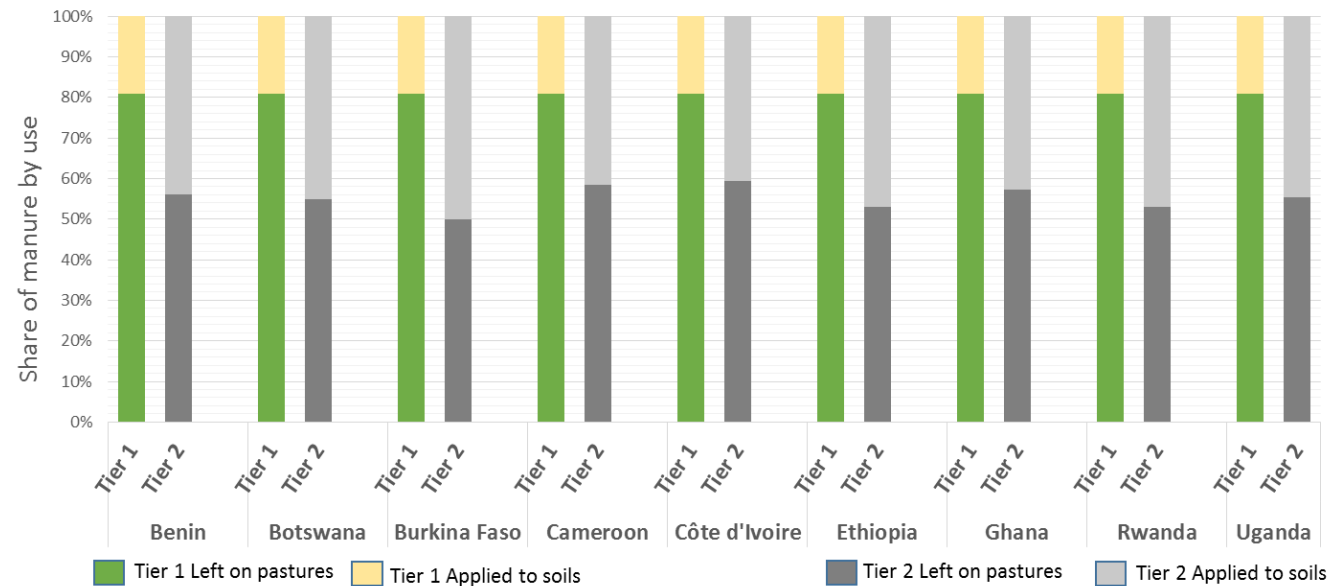
Share of manure
by use in Tier 1 and 2



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

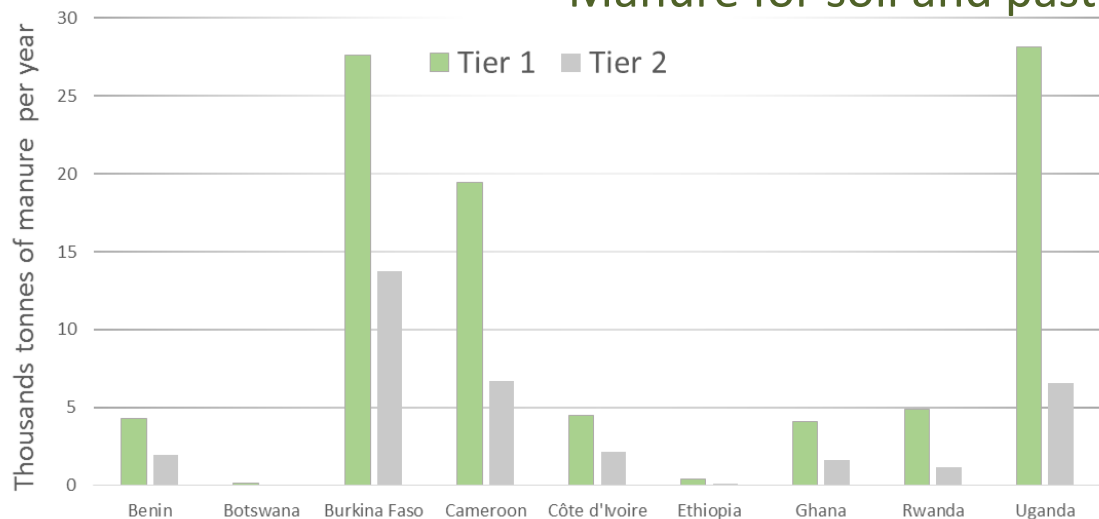


Share of manure
by Tier and use

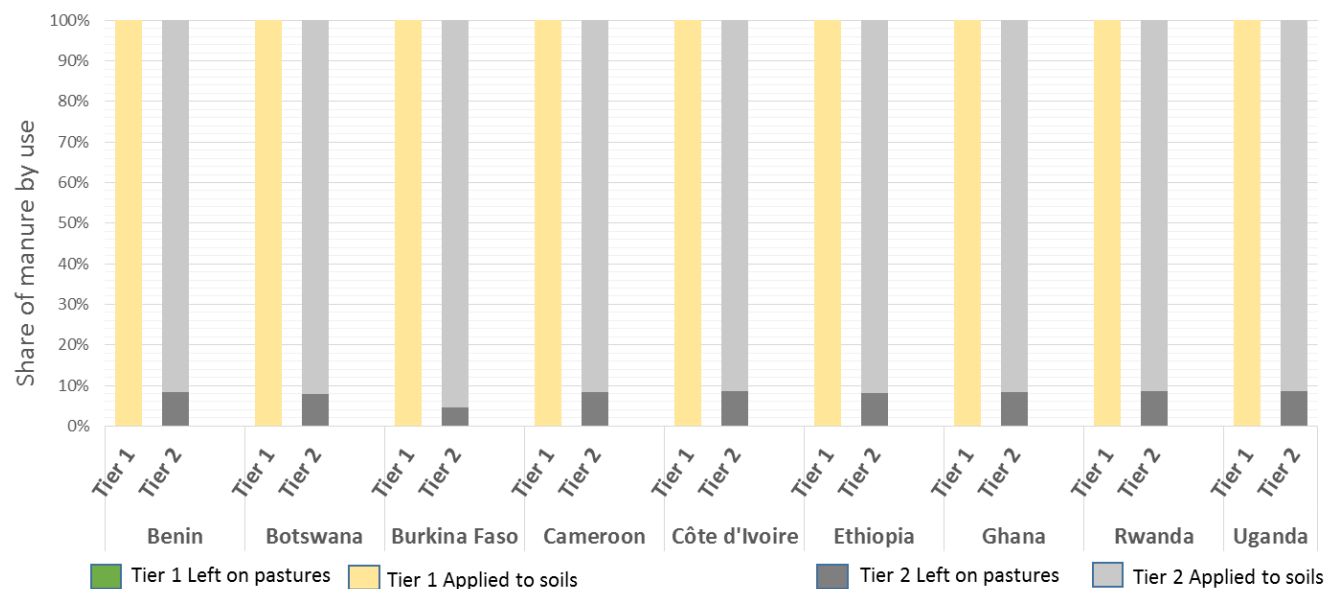


Results: both Tiers for pigs (*circa* year 2005)

Manure for soil and pasture applications

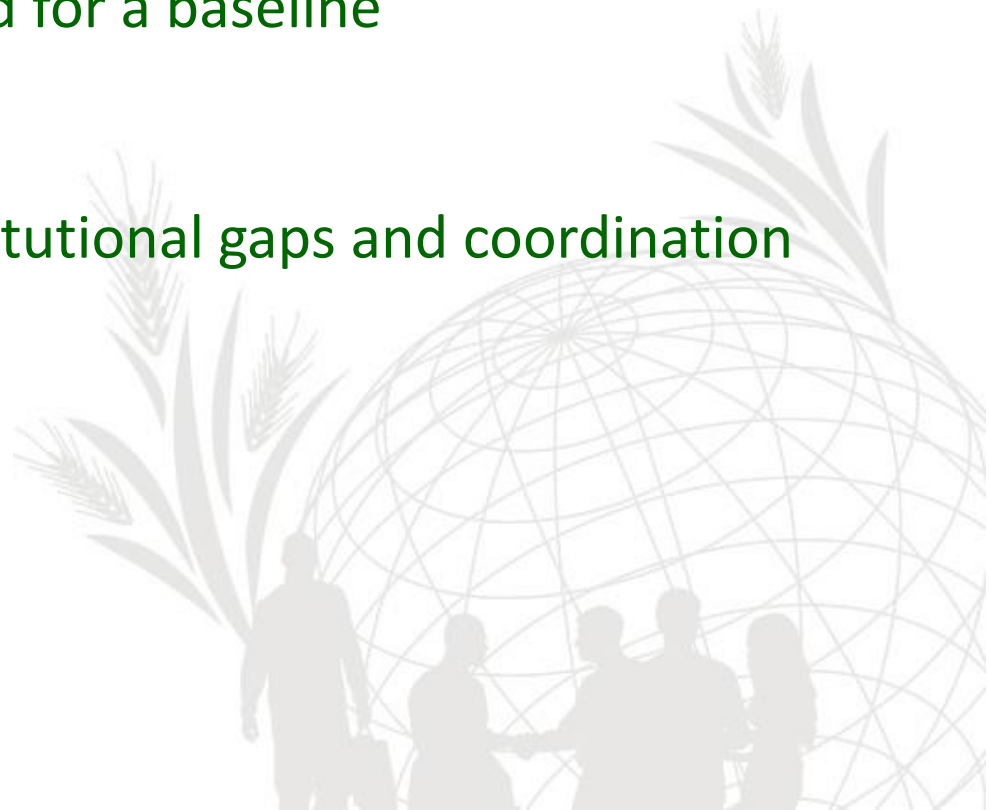


Share of manure by use in Tier 1 and 2



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														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	Household final consumption			Other changes			
Inorganic fertilizers																									
Nitrogen Fertilizers (N total nutrients)																									
Phostate Fertilizers (P ₂ O ₅ total nutrients)																									
Potash Fertilizers (K ₂ O 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																									

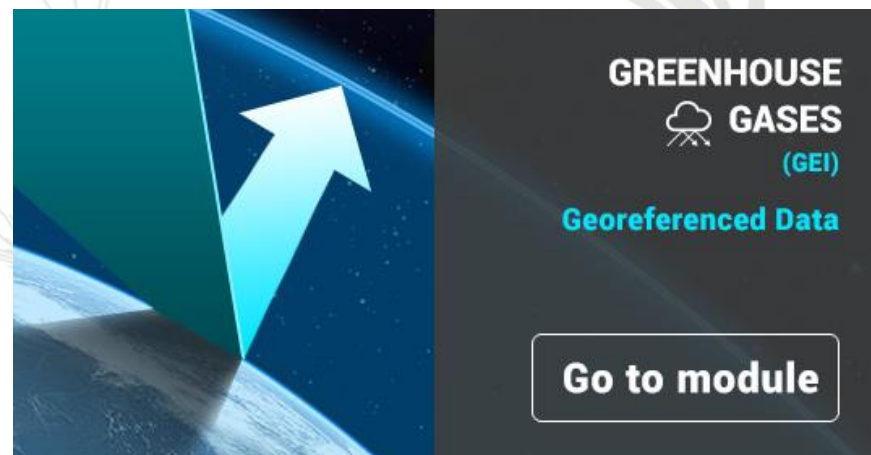
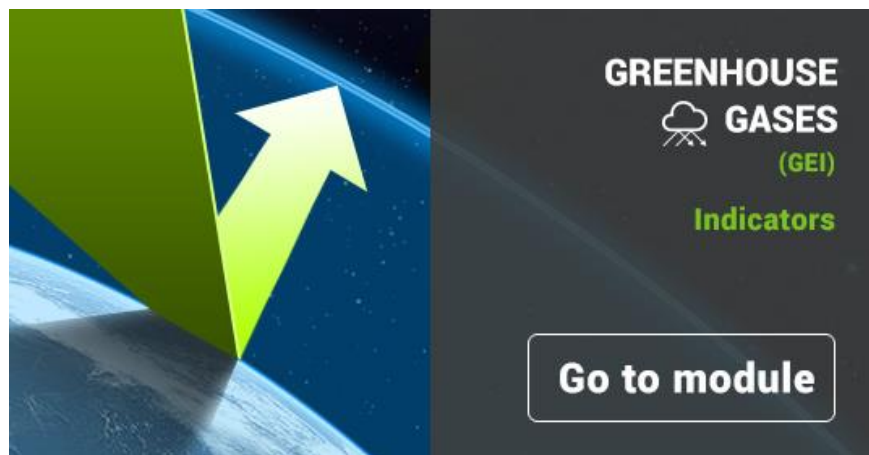
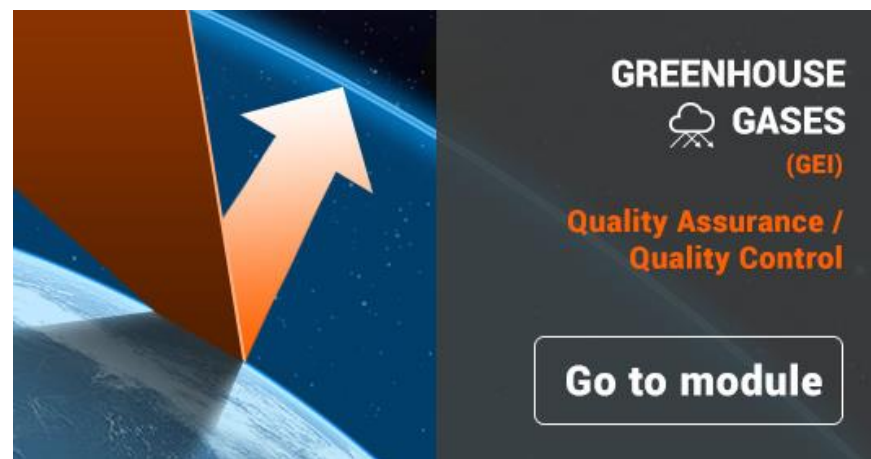
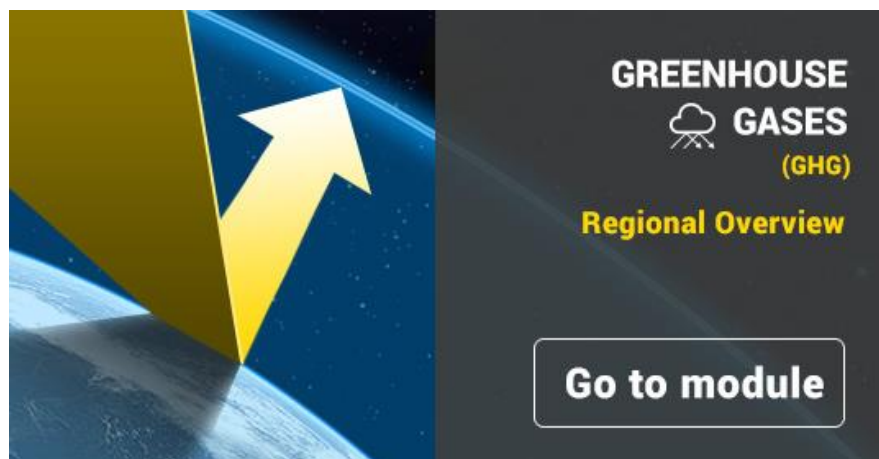
non-productive purpose: garden, use of manure as an energy source

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.

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-meteorology](#)



Food and Agriculture Organization
of the United Nations



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

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

Information difficult to collect

Response rates for questionnaires

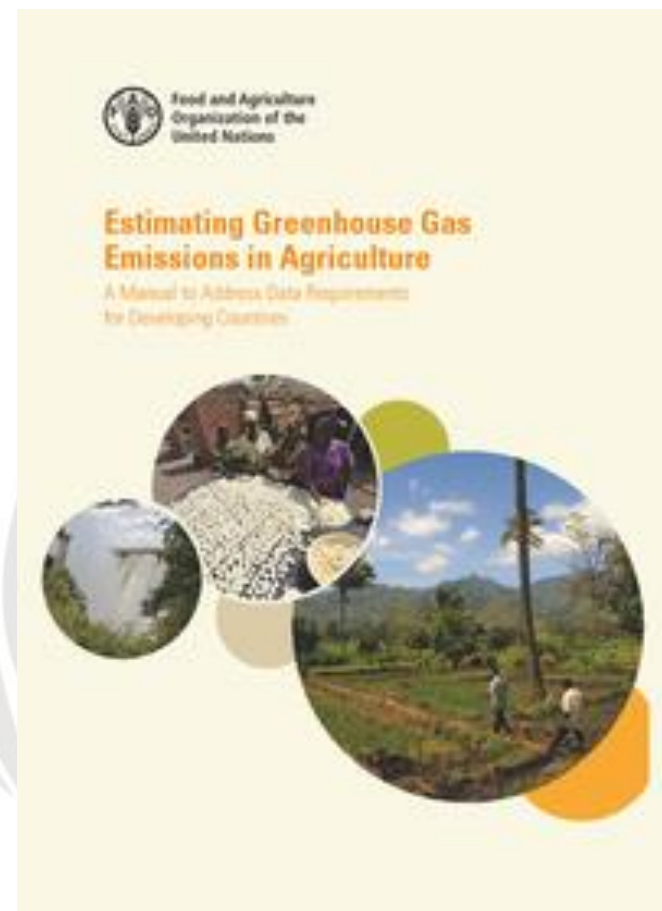


Region	Number of countries (a)	Number of questionnaires sent (a)	Response rate						
			2007	2008	2009	2010	2011	2012	2013
Eastern Africa	22	16	38%	31%	13%	31%	31%	31%	19%
Middle Africa	9	8	38%	13%	13%	25%	0%	0%	0%
Northern Africa	8	6	50%	50%	33%	33%	50%	50%	33%
Southern Africa	5	4	0%	25%	0%	25%	0%	25%	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