3rd Day – 17 April 2016:
The FAO Emissions database: GHG estimates for the Agriculture and Land Use sectors – Part I

This presentation is composed of two parts. Part I briefly reviews the statistical processes associated with the UN Framework Convention on Climate Change (UNFCCC) and the associated reporting mechanisms for greenhouse gas inventories (GHG) that were discussed in detail on the first day of the training. It then provides in-depth information on the development and applications of the FAO emissions database. The database is accessible through FAOSTAT and provides estimates of GHG for all countries worldwide and from 1990 to date for agriculture, forestry and other land use (AFOLU). Examples of relevant analyses (global, regional, sectoral and trends) are given and statistical and analytical tools based on the database are presented. These include the projections of emissions from agriculture in 2030 and 2050 and an instrument to compare GHG levels as reported in national communications to the corresponding emissions estimates in the FAO database.

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The FAO emissions database: GHG estimates for the agriculture and land use sectors Part I

15 –17 April 2016, Kampala, Uganda

ENVIRONMENT – TEAM
FAO STATISTICS DIVISION

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Outline

- Recap on UNFCCC and associated statistical processes; IPCC guidelines for GHG inventories
- Emissions from AFOLU, tiered approach and data implications;
- AFOLU sector and the Agriculture and Land Use database in FAOSTAT – Sources of activity data;
- Global and country analyses: supporting tool for strengthening climate change-relevant statistics

UNFCCC Goals and Approaches

Ultimate objective is to stabilize greenhouse gas concentrations

"at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system"

Such level should be achieved

"within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure and within a timeframe that ensures that food production is not threatened and to enable socio-economic development to proceed in a sustainable manner"

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Reporting to the Convention

Parties to the Convention **must submit national reports on implementation** of the Convention in accordance with the principle of "common by different responsibilities and capabilities"

The importance of reliable data: Accurate, consistent and internationally comparable data on GHG emissions is essential to take appropriate mitigation actions and ultimately to achieve the objective of the Convention.

Relevant and high quality information on most effective ways to mitigate and adapt to climate change **contributes towards global sustainable development**.

Monitoring Reporting and Verification; MRV	
Annex I Parties NGHGI, BRs REVIEW	**Non-Annex I** Parties NCs, BURs International Consultation and Analysis

Reporting mechanisms to the UNFCCC: non-Annex I

- **National communications** (NCs): information on GHG inventories, measures to mitigate and facilitate adaptation. 3 years after entering the Convention and every 4 years since;

http://unfccc.int/national_reports/nonannex_i_natcom/submitted_natcom/items/653.php

Uganda Oct. 2002 and Oct. 2014

- **Biennial Update Reports** (BURs): update on NC, GHG inventories, mitigation actions, constraints and gaps, support needed and received. Every 2 years after Dec. 2014.
  http://unfccc.int/national_reports/nonannex_i_natcom/reporting_on_climate_change/items/8722.php

  Least developed countries and small islands submission of BURs at their own discretion;

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non-Annex I LDCs and small islands

National Adaptation Programme of Actions (NAPAs): for LDCs (Uganda) and small islands focus on most urgent needs with regard to adaptation to climate change (use existing information).

NAPA I Uganda 2007

Uganda order of priorities (from UNFCCC-NAPA by country database)

1. Community Tree Growing Project;
2. Land Degradation Management Project;
3. Strengthening Meteorological Services;

4 & 5. Water resources (Sanitation and Water for Production);

6. Drought adaptation;
7. Vectors, Pests and Diseases control;
8. IK and Natural Resources Management;
9. Climate Change and Development Planning

Intended National Determined Contribution (INDC)

INDC, in preparation of the COP21 of Paris and after

Under a global framework that drives collective action towards a **low-carbon and climate-resilient future** and in **the context of national priorities, circumstances and capabilities**

- **Quantifiable information** on The reference point (including base year); Time frame and periods for implementation; Planning processes; Scope and coverage; Methodological approached including those for estimating and accounting for GHG emissions (and removals); Undertakings in adaptation planning;

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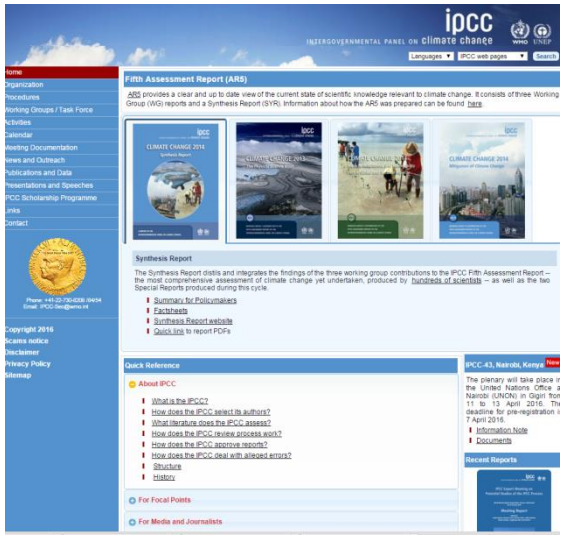
Intergovernmental Panel on Climate Change (IPCC)

International body for assessing the science related to climate change – Based on rigorous and balanced scientific information



Provide a **scientific basis** for governments to develop climate-related policies

WGI: Physical Science Basis;

WGII: Impacts, Adaptation & Vulnerability;

WGIII: Mitigation of Climate Change

TFI: **Task Force on National GHG Inventories**

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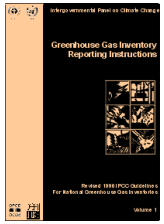
IPCC Guidelines for National GHG Emission Inventories

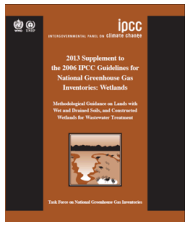
- **Revised 1996 Guidelines** for National Greenhouse Gas Inventories (Revised 1996 IPCC Guidelines), IPCC (1997);



- Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (GPG 2000), IPCC (2000);
- Good Practice Guidance for Land-Use, Land-Use Change and Forestry (GPG-LULUCF), IPCC (2003);

- **2006 IPCC Guidelines** for National Greenhouse Gas Inventories (2006 IPCC Guidelines), IPCC (2006) **VOL 4 AFOLU sector;**

- **2013 Supplement** to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: **Wetlands** (Wetlands Supplement), IPCC (2014);



- 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (KP Supplement), IPCC (2014);

The FAOSTAT Emissions Database: Implementing the IPCC guidelines for Agriculture, Forestry and Other Land use (AFOLU)

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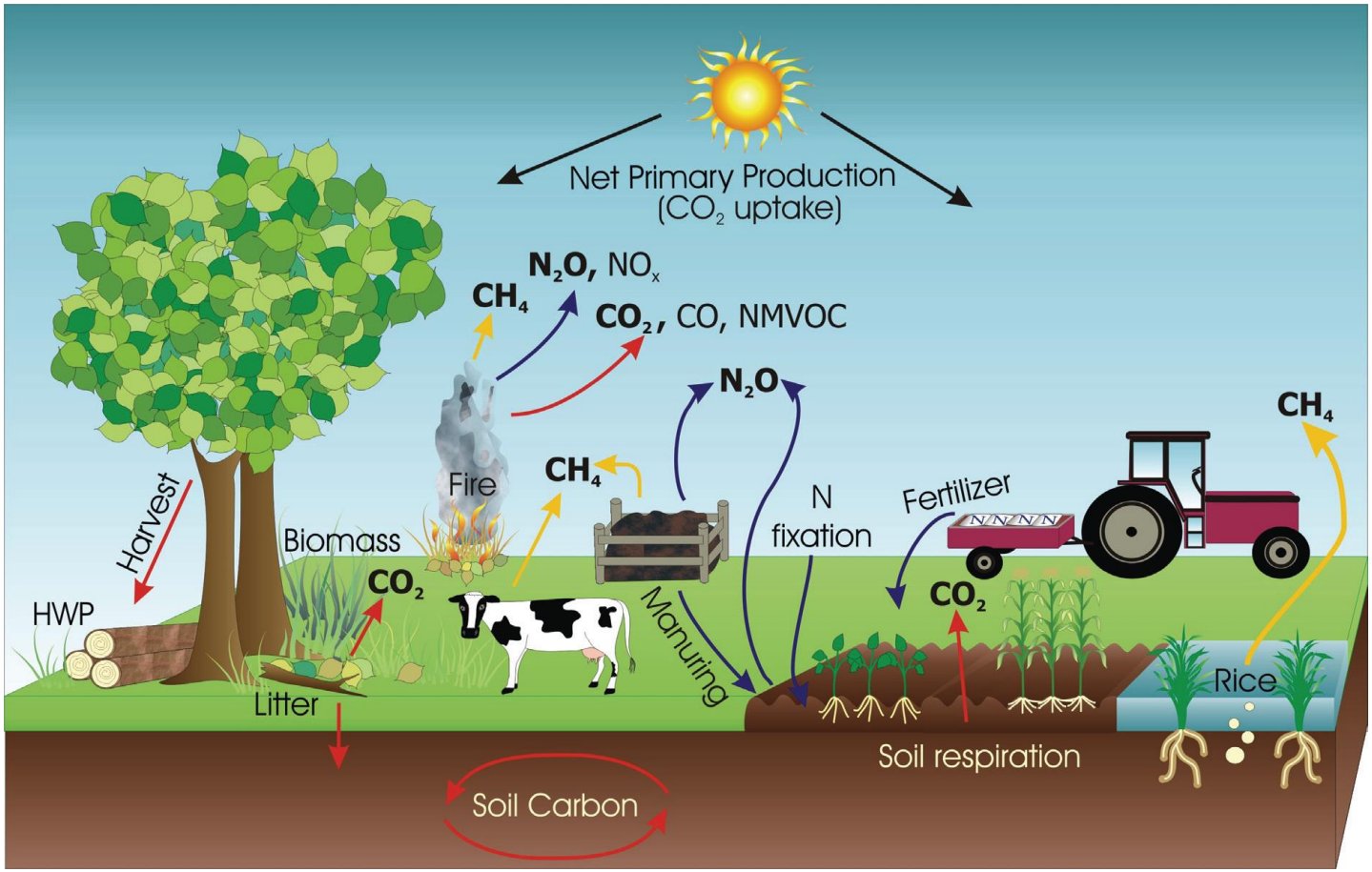
AFOLU Sector in National GHG Inventory

Biomass C Stock Changes

Non-CO_2 GHG Emissions from Burning



Soil N_2O Emissions

Rice Methane

Soil C Stock Changes

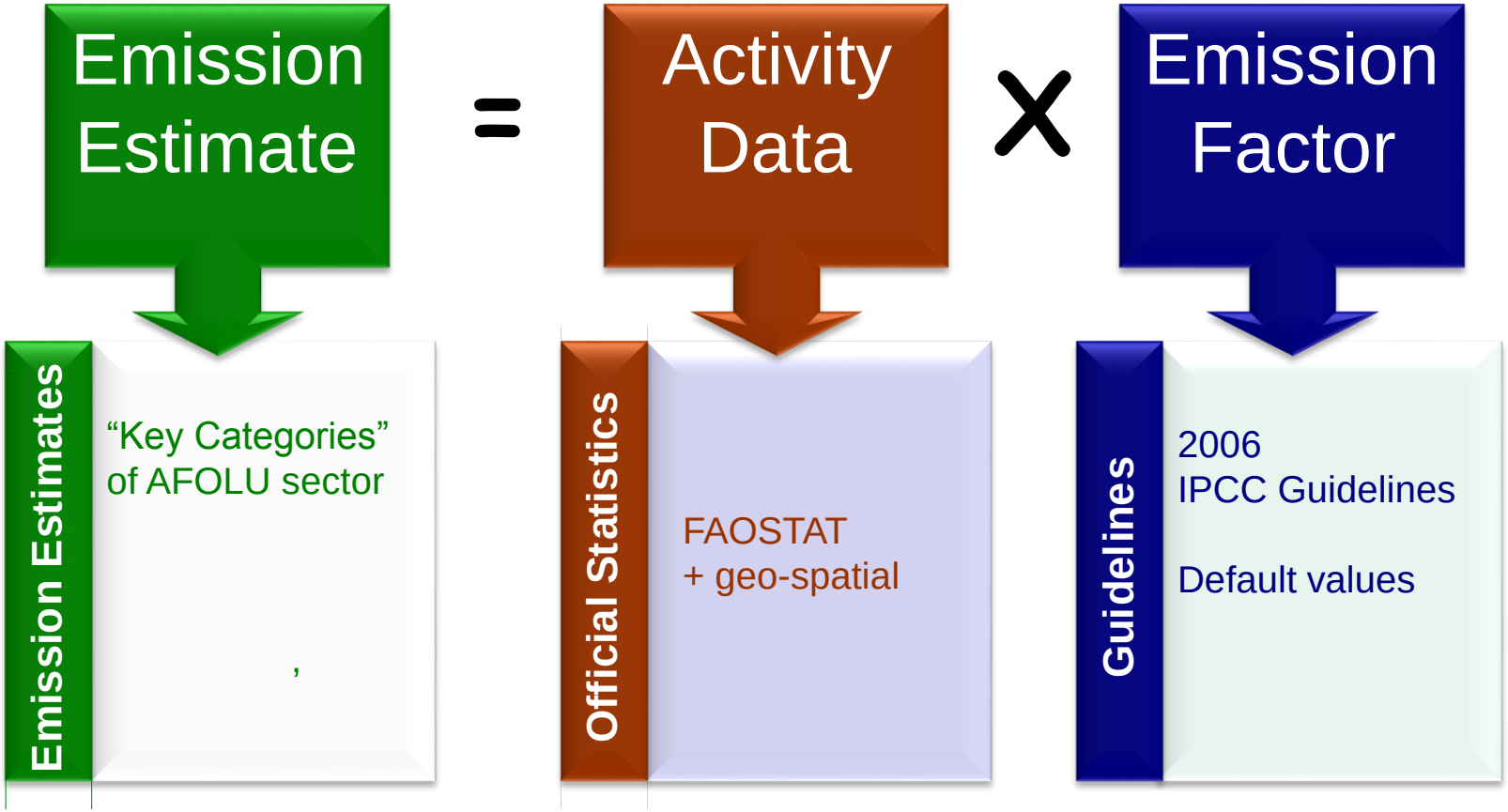
Enteric Methane

CH_4 and N_2O from Manure

From 2006 IPCC Guidelines

GHG emission estimates for the AFOLU sector

Multiply the amount or level of a human activity by an **emission factor,** which represents the emissions per unit of the activity.



A Phased Tiered Approach

Different levels of complexity (including institutional arrangements) and integration of country-specific information

IPCC Tiers	Estimation method	Coefficients	Activity data detail
Tier 1	Empirical	Default	Low
Tier 2	Empirical/ Simulated	Country-specific	Medium
Tier 3	Simulation/ measured inventory	Country-specific	High

Quantifying emissions by source and removals by sink

A Phased Tiered Approach

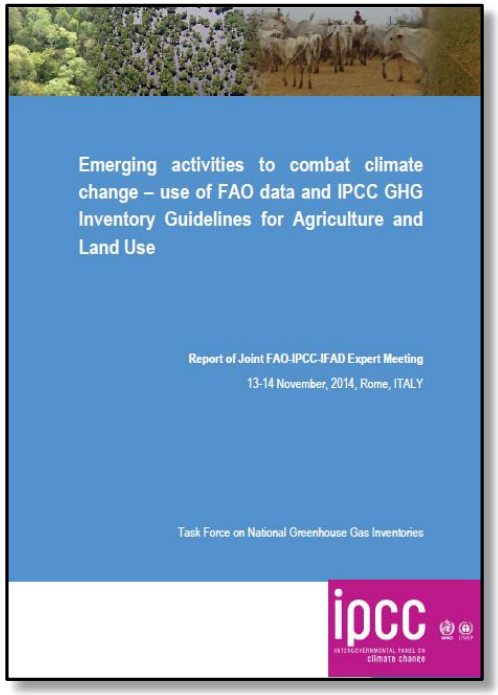
Different levels of complexity (including institutional arrangements) and integration of country-specific information

	Accuracy	Precision	Complexity
IPCC Tiers	**Estimation method**	**Coefficients**	**Activity data detail**
Tier 1	**Empirical**	**Default**	**Low**
Tier 2	**Empirical/ Simulated**	**Country-specific**	**Medium**
Tier 3	**Simulation/ measured inventory**	**Country-specific**	**High**

Quantifying emissions by source and removals by sink

FAO Statistical Work on GHG Emissions

- FAO database with estimates and updates GHG Emissions from AFOLU;
- 1961-2014 (Agriculture); 1990-2015 (LULUCF): ~185 Countries
- Reference **Tier 1** GHG Inventory using 2006 IPCC Guidelines:
  - Facilitate national, regional and global analysis, including IPCC Assessment Reports
  - Support member countries report under UNFCCC, addressing data gaps and needs in data QA/QC
  - Explore policy-relevant emission indicators in support of analyses linked to resilience, food security, including SDGs processes



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www.ipcc-nggip.iges.or.jp/public/mtdocs/pdfiles/1411_FAO-IPCC-IFAD_Rome_AFOLU.pdf

FAOSTAT Emissions Database

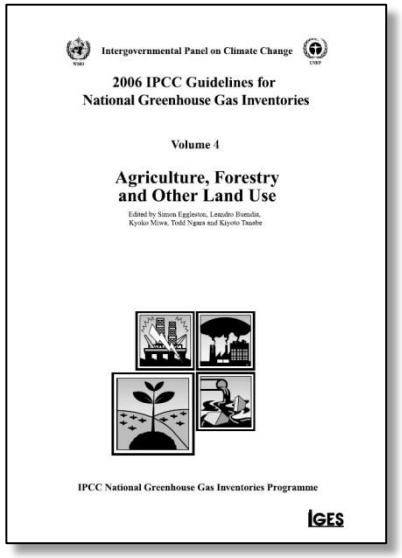
FAOSTAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
STATISTICS DIVISION

& geo-referenced data

+

IPCC 2006 GUIDELINES


Intergovernmental Panel on Climate Change

2006 IPCC Guidelines for
National Greenhouse Gas Inventories

Volume 4

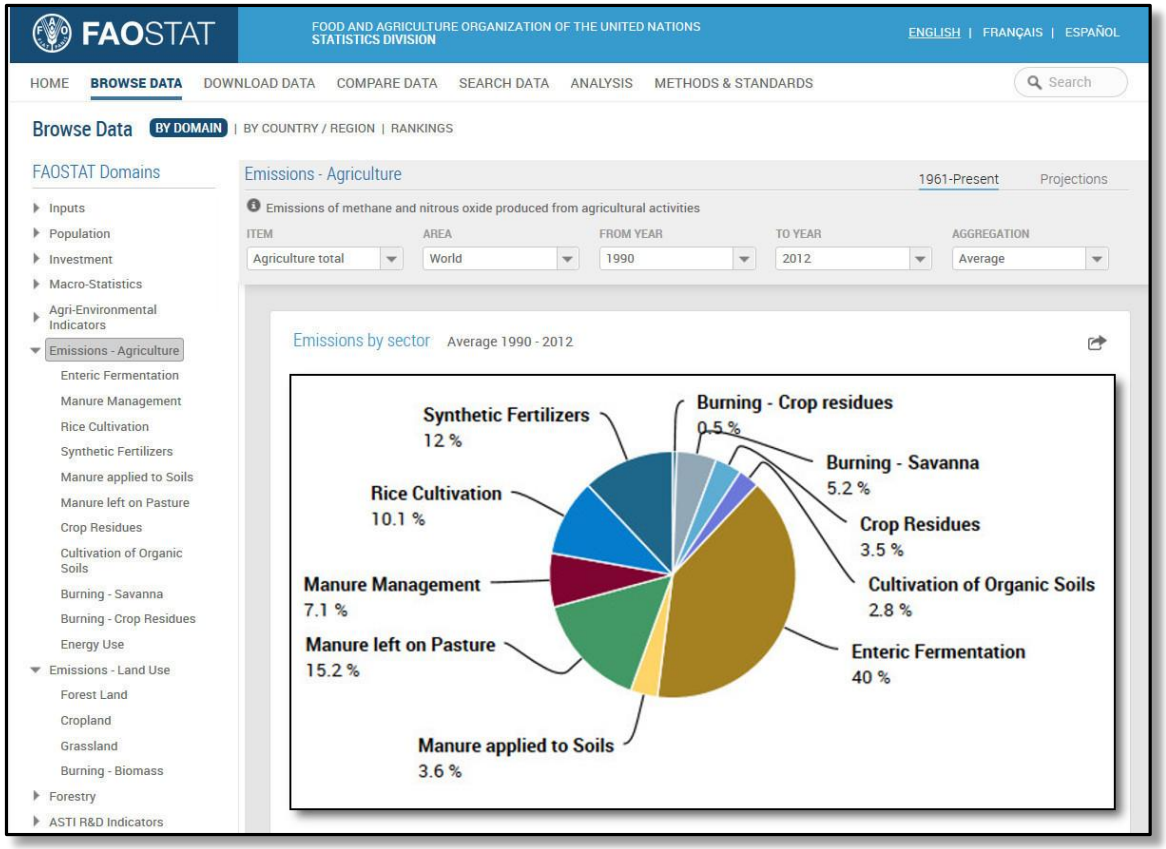
Agriculture, Forestry
and Other Land Use

Edited by Simon Eggleston, Leandro Buendia, Kyoko Miwa, Todd Ngara and Kiyoto Tanabe

IPCC National Greenhouse Gas Inventories Programme

IGES

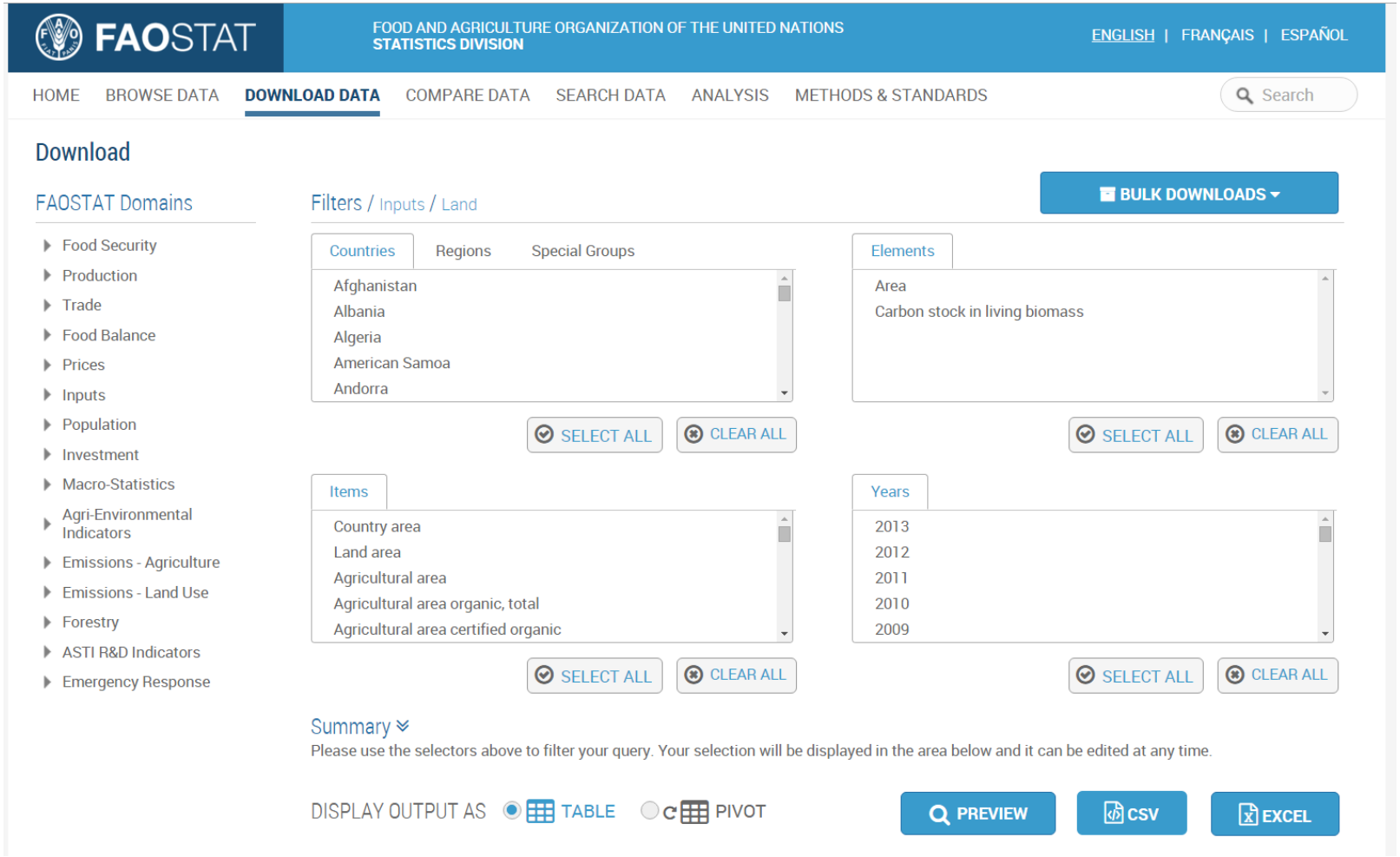
www.ipcc-nggip.iges.or.jp /public/2006gl/



http://faostat3.fao.org/browse/G1/*/E

FAOSTAT – Corporate Statistical Database

FAOSTAT database for AFOLU



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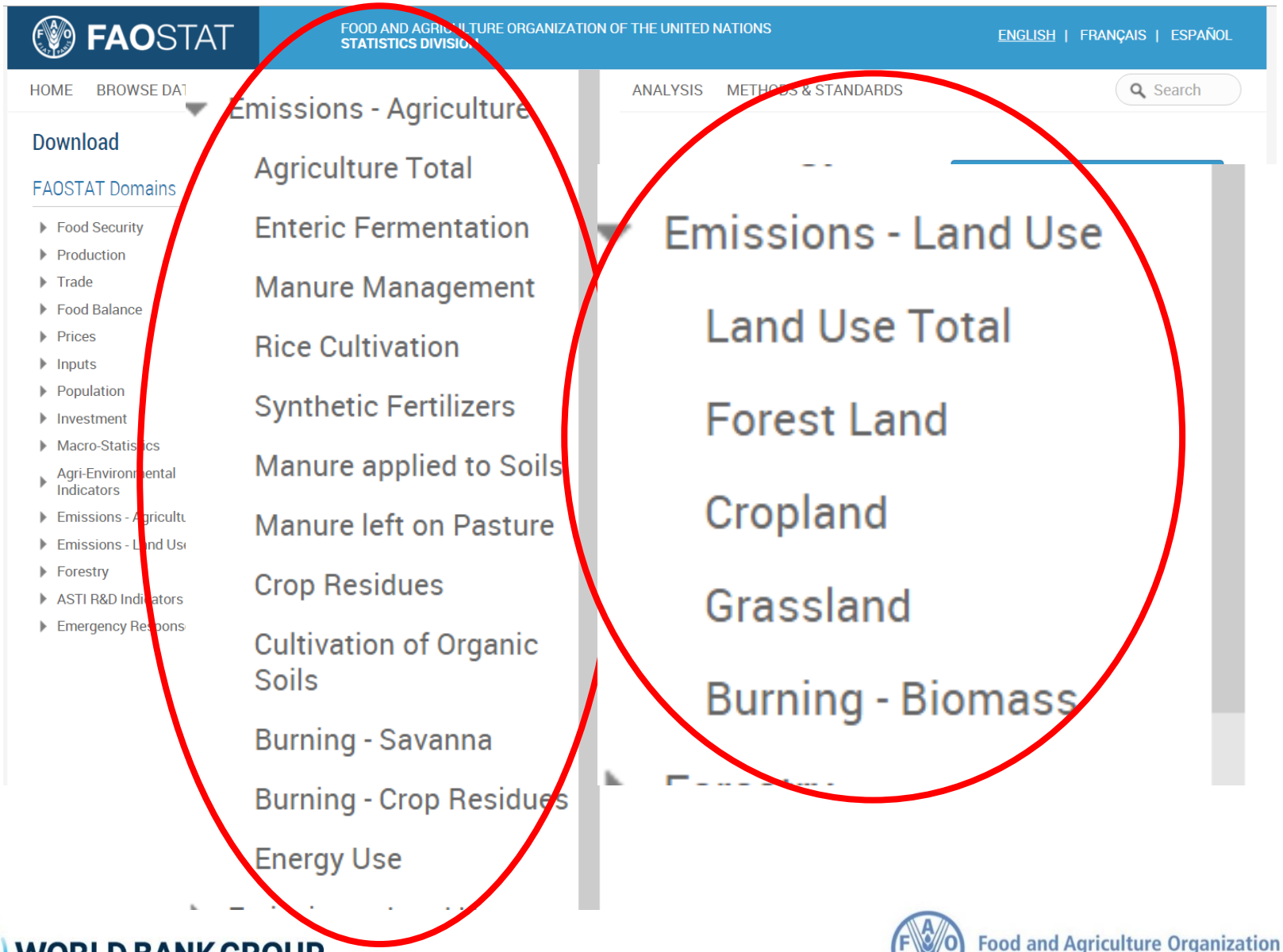
FAOSTAT database for AFOLU



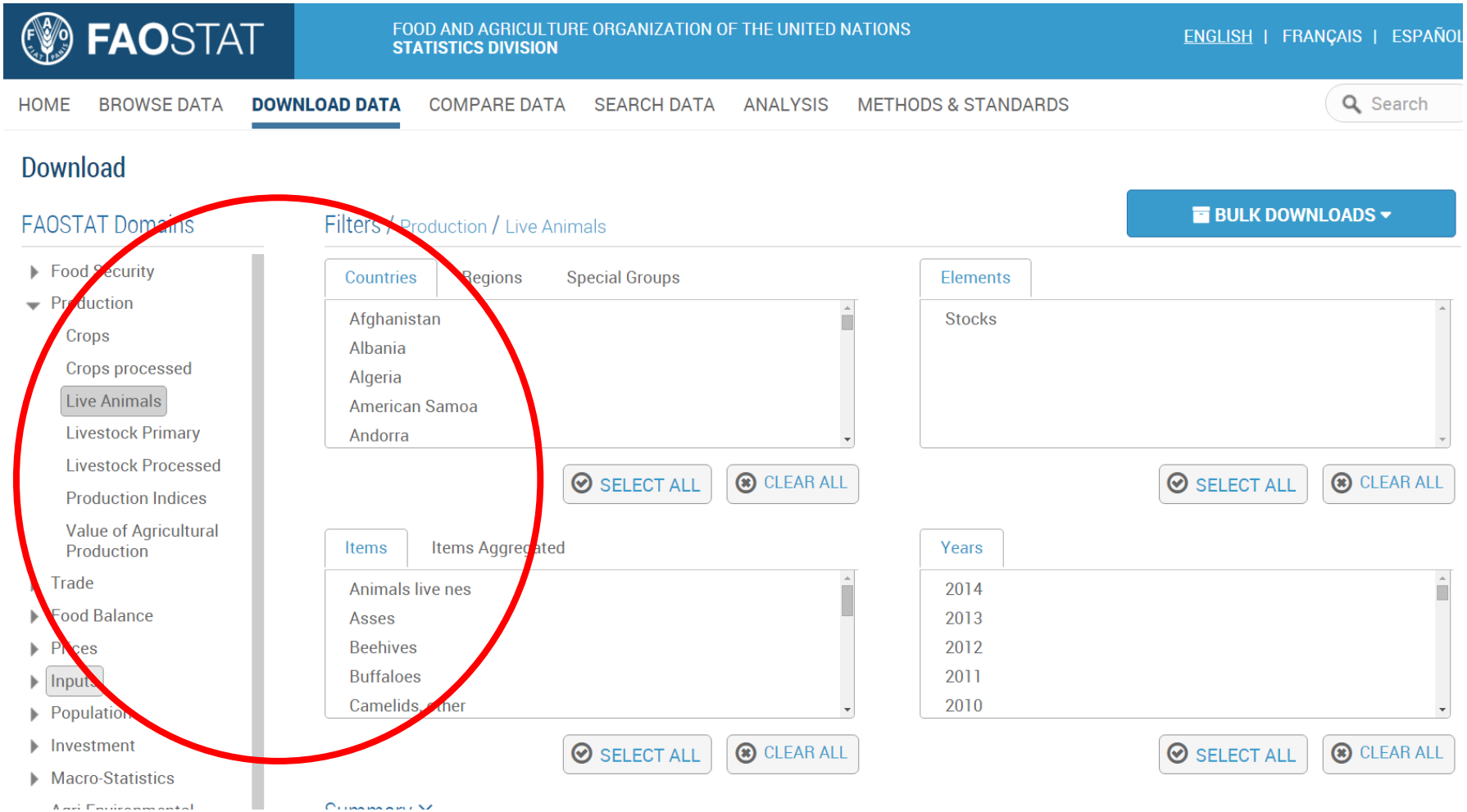
GHG Emissions Statistics: Categories

DOMAIN	CATEGORY		GAS reported	Data source
Agriculture	Enteric Fermentation		CH_4	FAOSTAT
	Manure Management		CH_4, N_2O	FAOSTAT
	Rice Cultivation		CH_4	FAOSTAT
	Agricultural soils	Synthetic Fertilizers	N_2O	FAOSTAT
		Manure applied to soils	N_2O	FAOSTAT
		Manure left on pasture	N_2O	FAOSTAT
		Crop residues	N_2O	FAOSTAT
		Cultivated organic soils	N_2O	HWSD, GLC2000
	Burning - Savanna		CH_4, N_2O	GFED4, JRC, FRA-GEZ
	Burning – Crop residues		CH_4, N_2O	FAOSTAT

DOMAIN	CATEGORY	GAS reported	Data source
LULUCF	Forest land	CO_2	FRA
	Cropland	CO_2	HWSD, GLC2000
	Grassland	CO_2	HWSD, GLC2000
	Burning Biomass	CH_4, N_2O, CO_2	GFED4, HWSD
	Wetlands	CO_2	
	Settlements	CO_2	
	Other land	CO_2	

http://faostat3.fao.org/faostat-gateway/go/to/browse/G1/*/E

ACTIVITY DATA: Production domains (crop and livestock)



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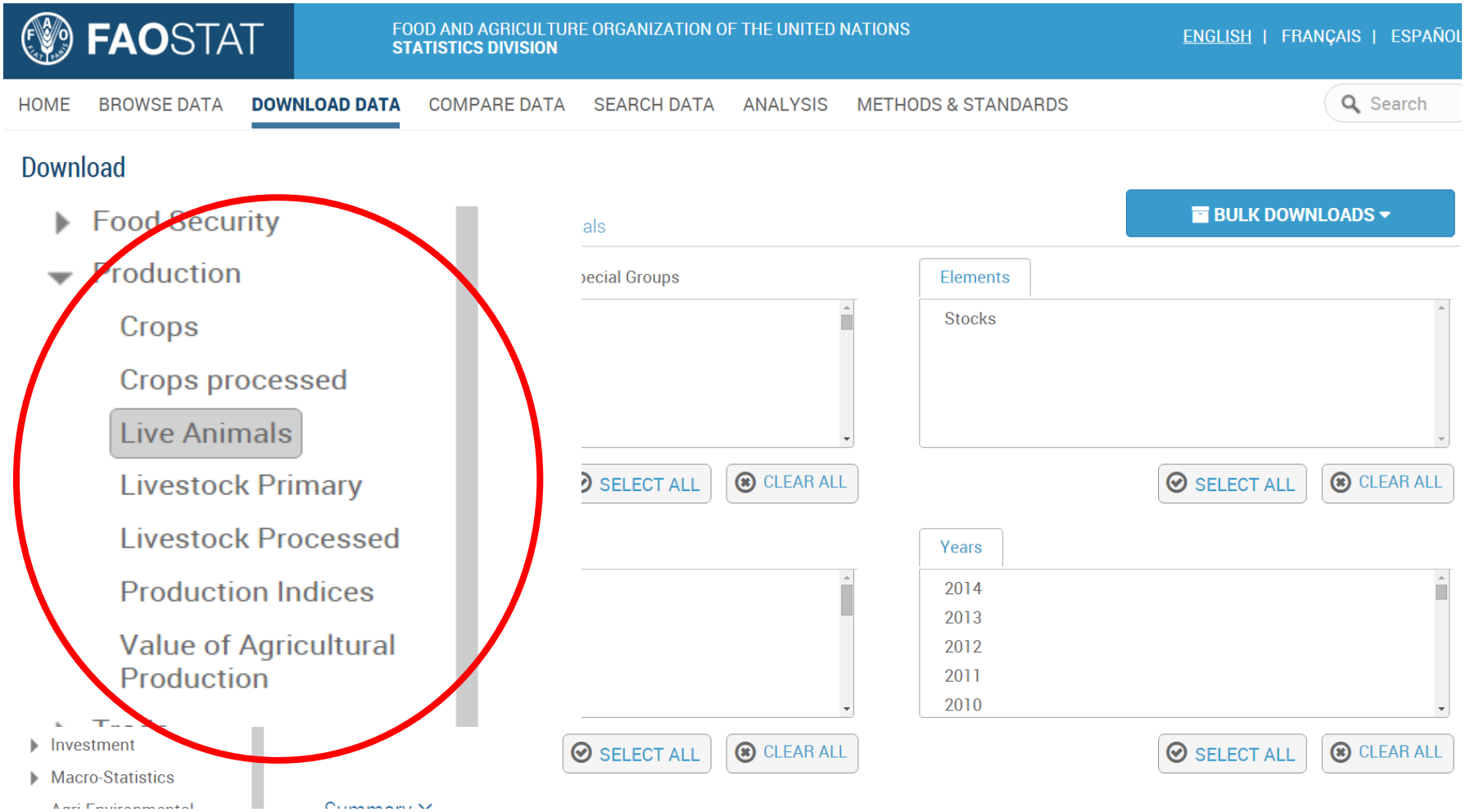
ACTIVITY DATA: Production domains (crop and livestock)



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Activity data: Inputs (Fertilizers, Pesticides, Land)

FAOSTAT

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FAOSTAT Domains

- Food Security
- Production
- Trade
- Food Balance
- Prices
- Inputs
  - Fertilizers
  - Fertilizers archive
  - Fertilizers - Trade Value
  - Pesticides (use)
  - Pesticides (trade)
  - Land
  - Employment Indicators
- Population
- Investment
- Macro-Statistics
- Agri-Environmental Indicators
- Emissions - Agriculture
- Emissions - Land Use
- Forestry
- ASTI R&D Indicators

Filters / Inputs / Fertilizers

BULK DOWNLOADS

Countries | Regions | Special Groups

Afghanistan
Albania
Algeria
American Samoa
Andorra

SELECT ALL | CLEAR ALL

Elements

Production Quantity
Production Quantity in nutrients
Import Quantity
Import Quantity in nutrients
Export Quantity

SELECT ALL | CLEAR ALL

Items

Nitrogen Fertilizers (N total nutrients)
Phosphate Fertilizers (P205 total nutrients)
Potash Fertilizers (K20 total nutrients)
Ammonia, anhydrous
Ammonium nitrate

SELECT ALL | CLEAR ALL

Years

2013
2012
2011
2010
2009

SELECT ALL | CLEAR ALL

Summary

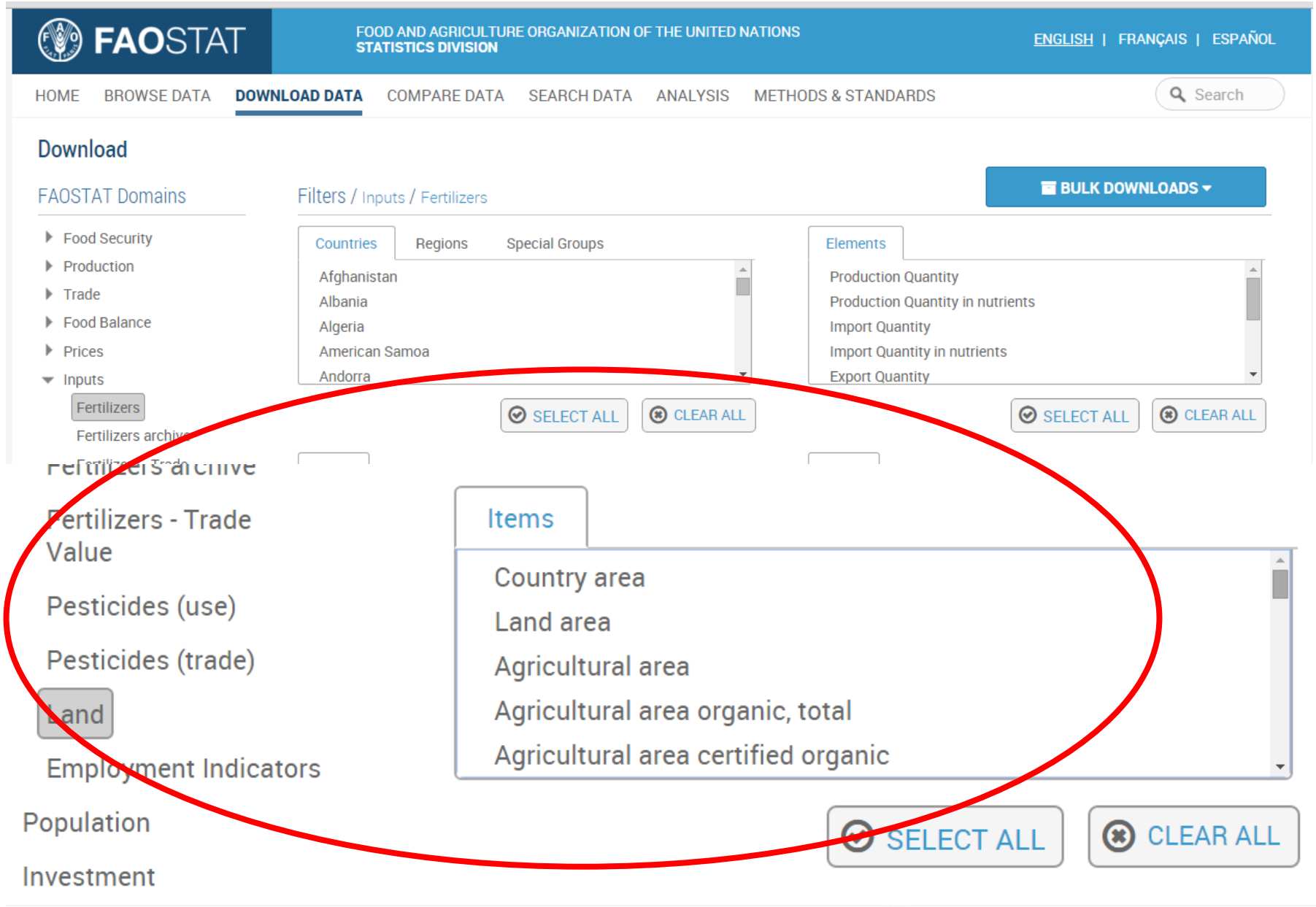
Please use the selectors above to filter your query. Your selection will be displayed in the area below and it can be edited at any time.

DISPLAY OUTPUT AS TABLE PIVOT

PREVIEW | CSV | EXCEL

of the United Nations

Activity data: Inputs (Fertilizers, Pesticides, Land)



Forest Land – Integration with FRA statistics

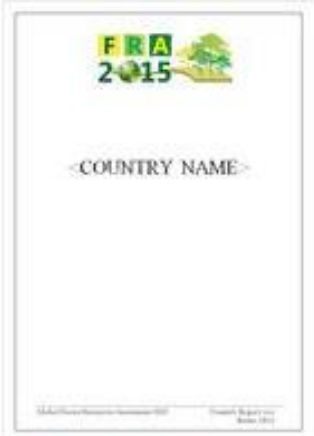
- **1990 – 2015** (every 5 years);
- **Country reporting process** is the backbone of Global Forest Resources Assessment (FRA);
- Countries elaborate and submit comprehensive report with a **standardized format and methodology** – National Correspondents;
- **FRA statistics** feed the corresponding Forestry statistics under the **FAOSTAT / Inputs/ Land domain;**
- Source of **activity data and carbon density data** for estimation of emissions from forest;

http://www.fao.org/forest-resources-assessment/current-assessment/en/

Synthesis document

Desk reference

Journal papers

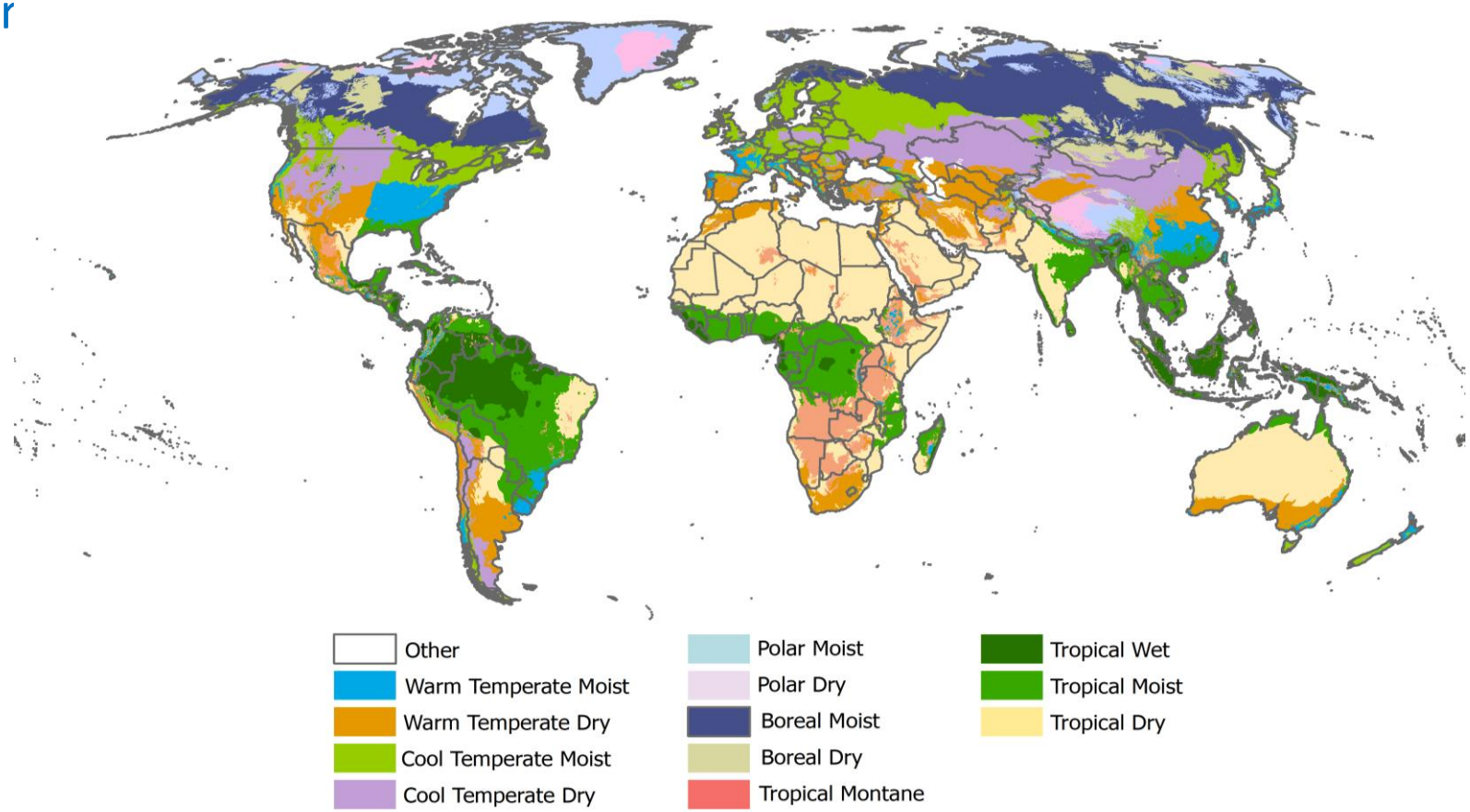


Country reports

Geospatial as source/complement for activity data

Specific EFs factors vary by climatic zone (e.g. estimate emissions from organic soils; fuel biomass consumption values): the JRC map of climatic zones

http://esdac.jrc.ec.europa.eu/content/support-renewable-energy-dir

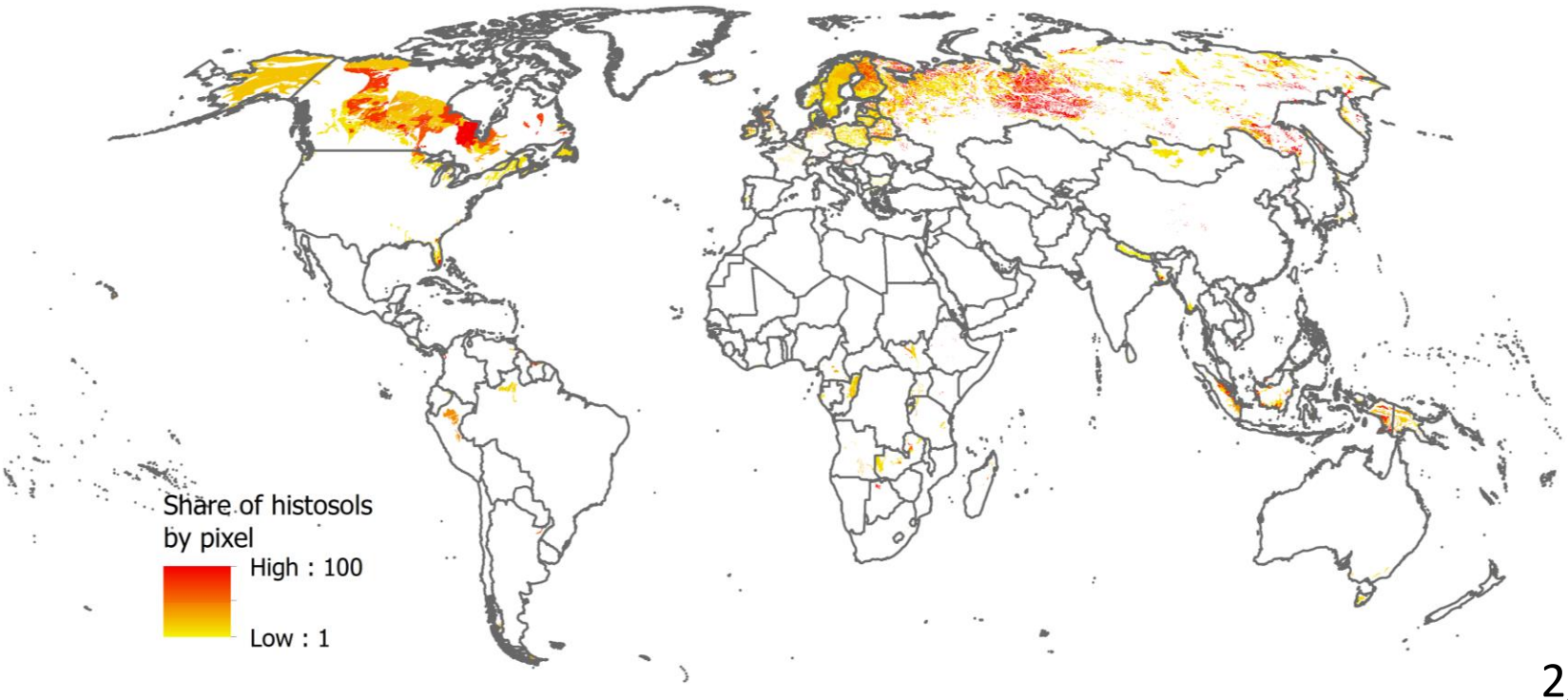


Geospatial as source/complement for activity data

Spatial distribution of organic soils derived from the Harmonized World Soil Database v2.1 (**HWSD**)

http://www.fao.org/soils-portal/soil-survey/soil-maps-and-databases/harmonized-world-soil-database-v12/en/

Organic soils and drained organic soils (available for download in FAO GeoNetwork): http://www.fao.org/geonetwork/srv/en/main.home

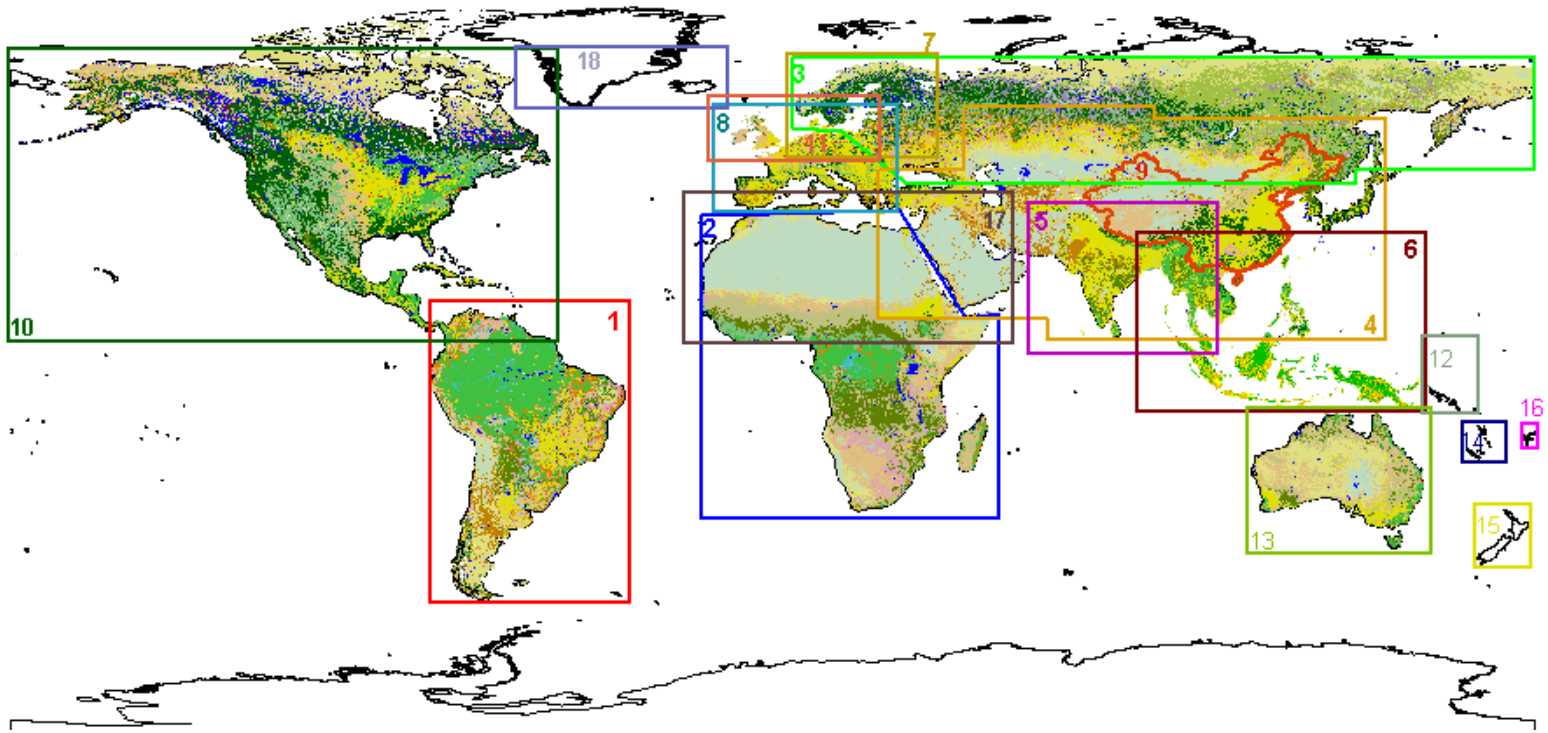


Geospatial as source/complement for activity data

Cultivation on organic soils: Global Land Cover 2000 database (GLC2k)

http://forobs.jrc.ec.europa.eu/products/glc2000/products.php

and literature information to derive crop percentage for mosaic classes

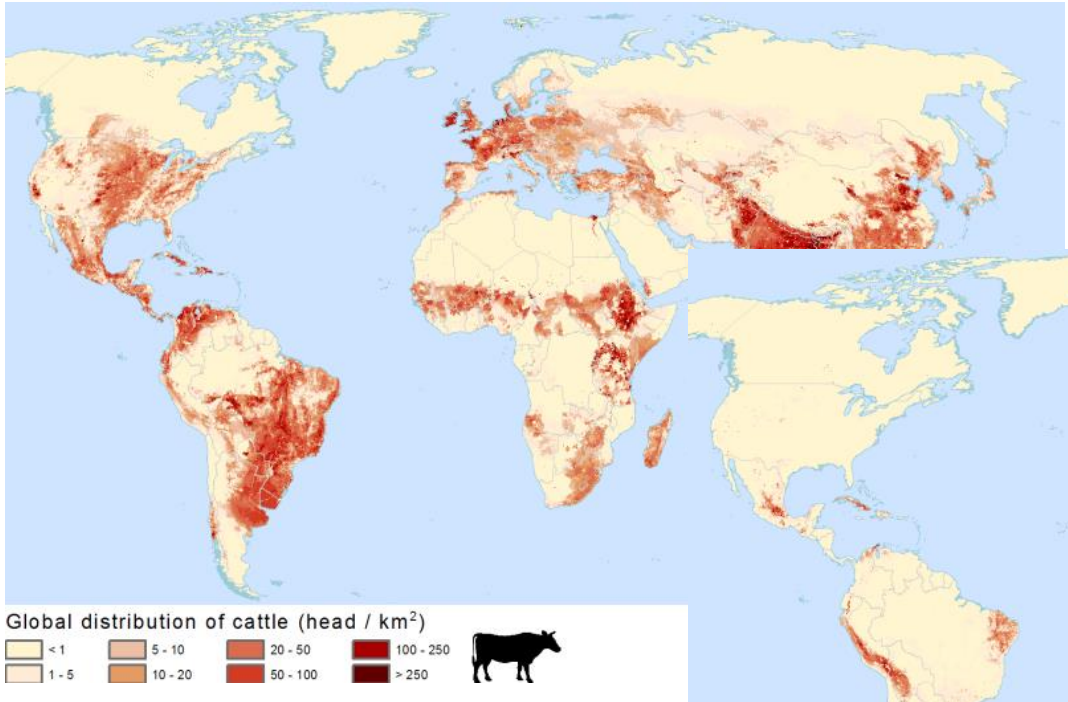


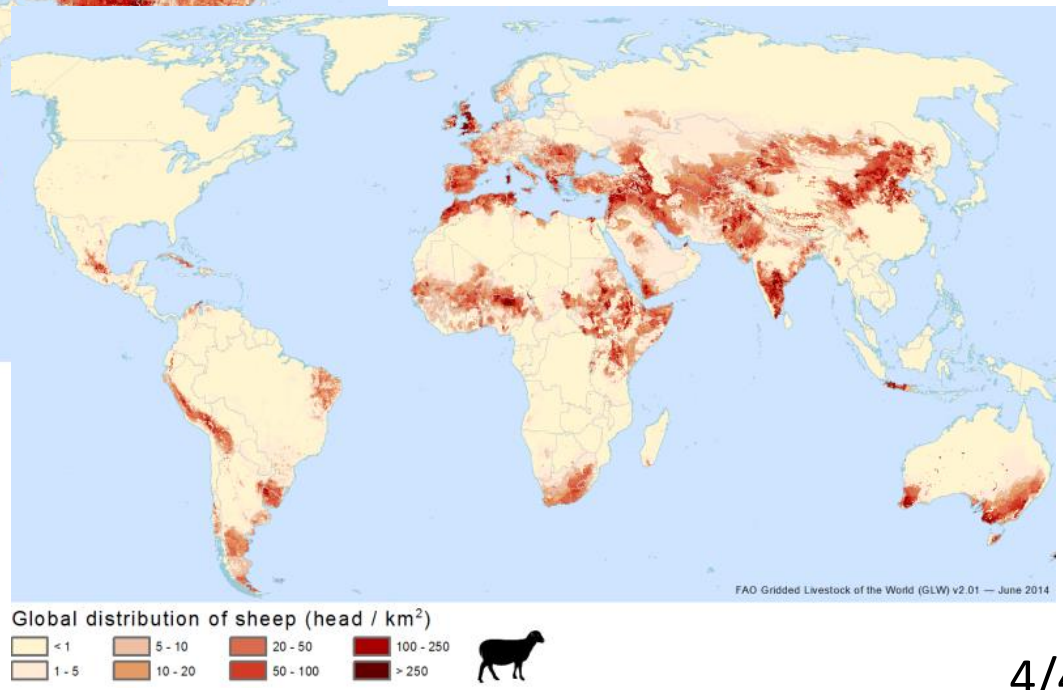
Year 2000

Geospatial as source/complement for activity data

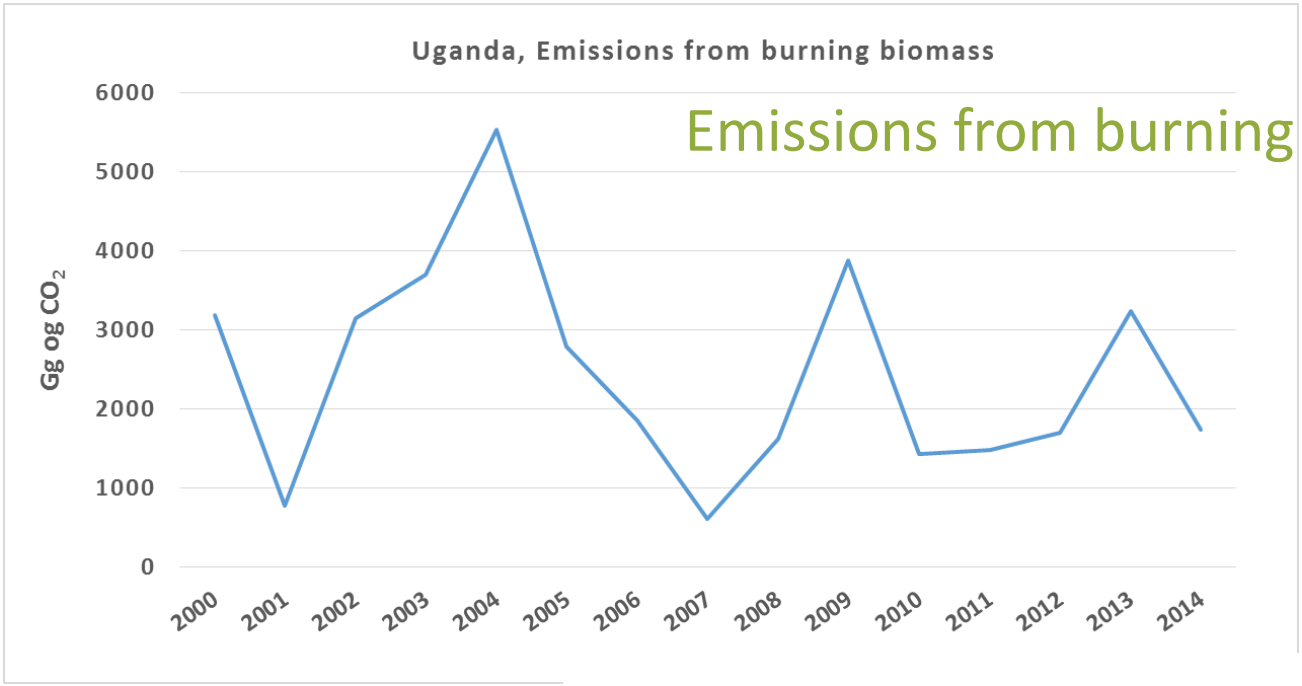
Drainage due to livestock grazing on organic soils: densities of livestock (Gridded Livestock of the World) - queried for livestock presence in organic soils

Spatial layers available (GLW 1 and 2) for download in FAO GeoNetwork

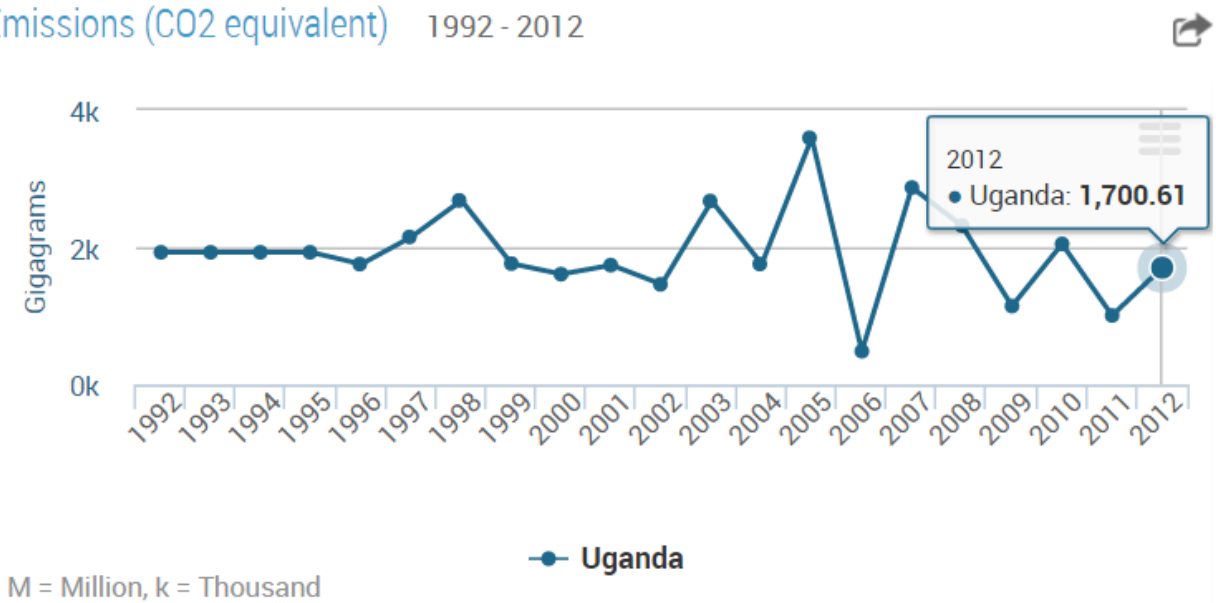




Adjusted to the year 2000



Emissions from burning biomass



Emissions from burning savanna

Geospatial as source/complement for activity data

Processed yearly composite of monthly burned areas from the Global Fire Emission Database v4 (**GEFD4, Giglio et al. 2013**)
http://www.globalfiredata.org/
for:

1) CH_4 and N_2O Emissions – Agriculture/Burning Savanna (for the following categories: Savanna; Woody Savanna; Closed Shrubland; Open Shrubland; Grassland. Land cover categories as defined by **MODIS Land Cover product** (MCD12Q1, Hansen et al., 2000): Methodological note: http://faostat3.fao.org/modules/faostat-download-js/PDF/EN/GH.pdf

2) CH_4 and N_2O Emissions and CO_2 emissions (for organic soils only) – Land Use/ Burning Biomass (for the following categories Humid Tropical forest; Other forest; Organic soils. Forest categories as defined by **FAO-FRA Global Ecological Zones** (FAO-FRA 2012)
http://www.fao.org/docrep/017/ap861e/ap861e00.pdf
and Organic soils defined as histosols in the Harmonized World Soil Database v 1.2 (**HWSD**) http://www.fao.org/soils-portal/soil-survey/soil-maps-and-databases/harmonized-world-soil-database-v12/en/

Geospatial as source/complement for activity data

Processed: yearly composite of monthly burned areas from the Global Fire Emission Database v4 (**GEFD4**)

Browse Data | Download Data

Data Type: Processed Activity Data

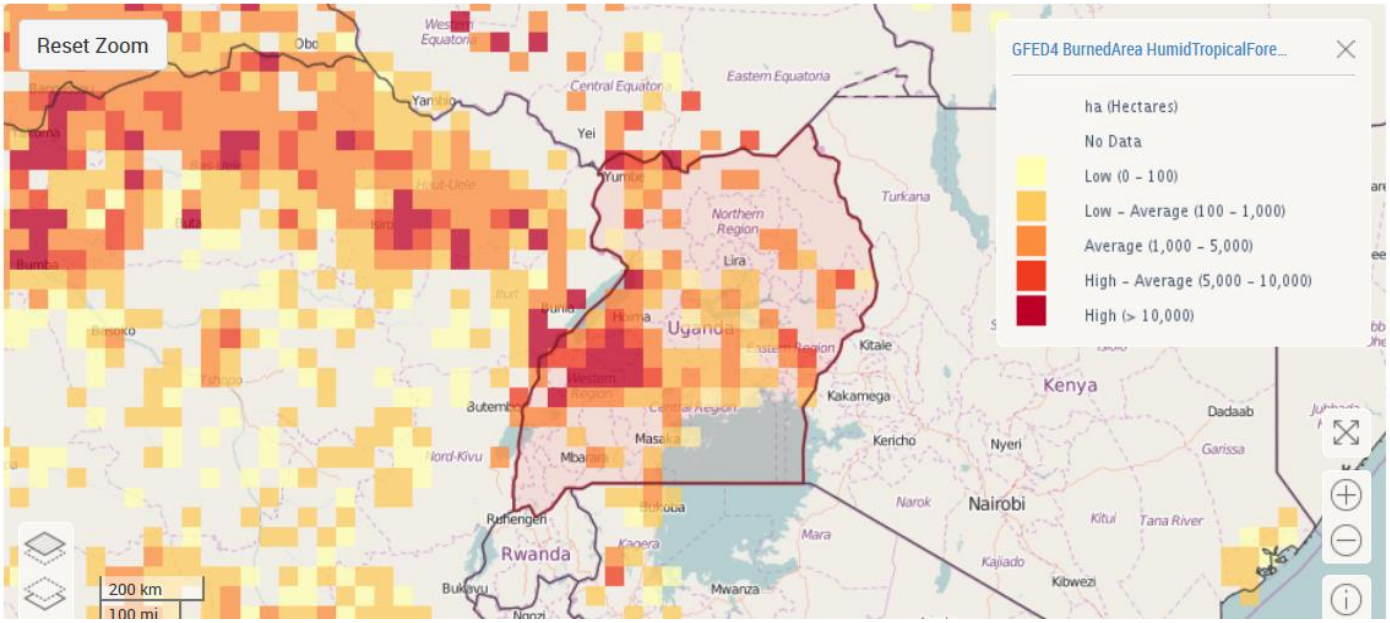
Product: GFED4 Burned Areas (yearly)

Land: **Humid Tropical Forest**

Year: 2012

Country: Uganda

Future steps:
Dissemination of spatial data (processed; implied EFs; emission estimates) through FAO GeoNetwork



Geospatial as source/complement for activity data

Processed: yearly composite of monthly burned areas from the Global Fire Emission Database v4 (**GEFD4**)

Data Type

Processed Activity Data

Product

GFED4 Burned Areas (yearly)

Other Forest

Other Forest

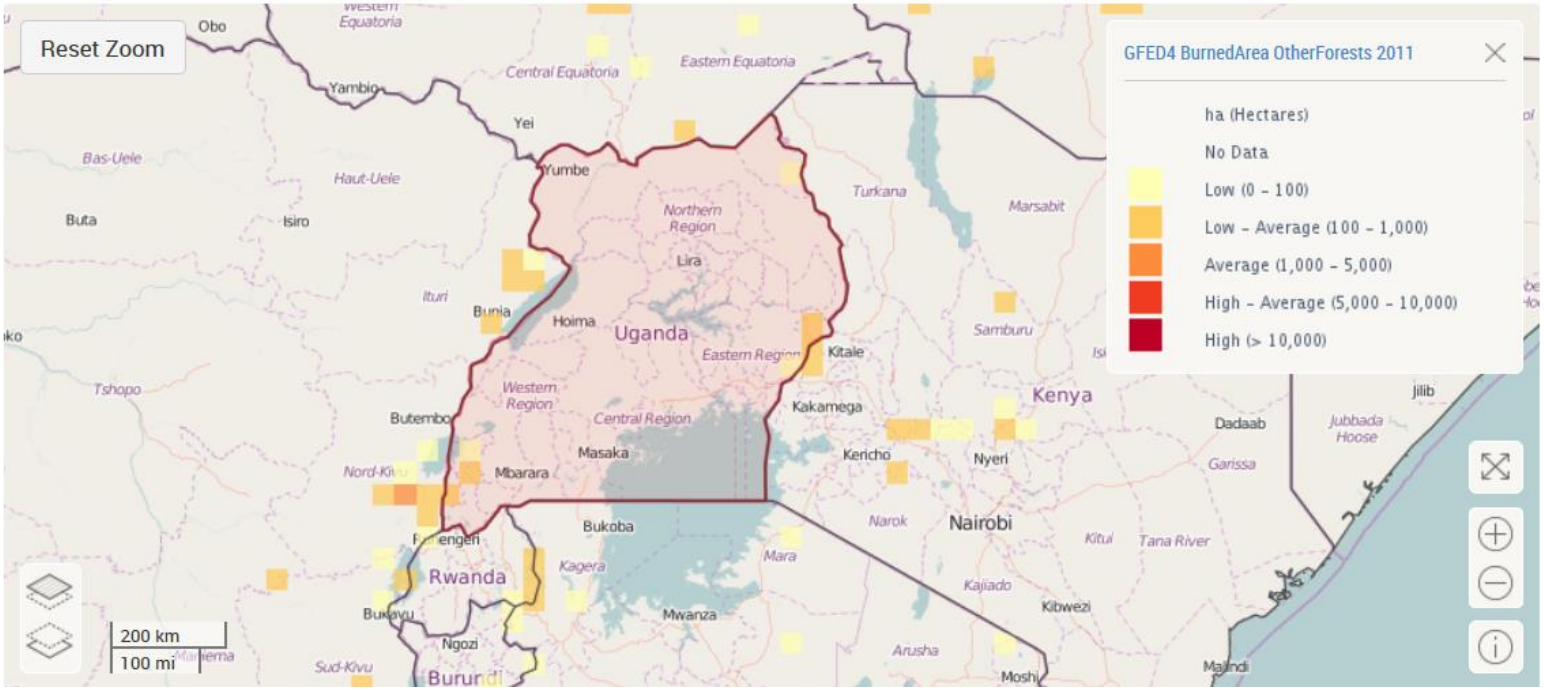
Year

2011

Country

Uganda

Future steps:
Dissemination of spatial data (processed; implied EFs; emission estimates) through FAO GeoNetwork



Geospatial as source/complement for activity data

Processed: yearly composite of monthly burned areas from the Global Fire Emission Database v4 (**GEFD4**)

Data Type

Processed Activity Data

Product

GFED4 Burned Areas (yearly)

Layer **Savanna**

Savanna

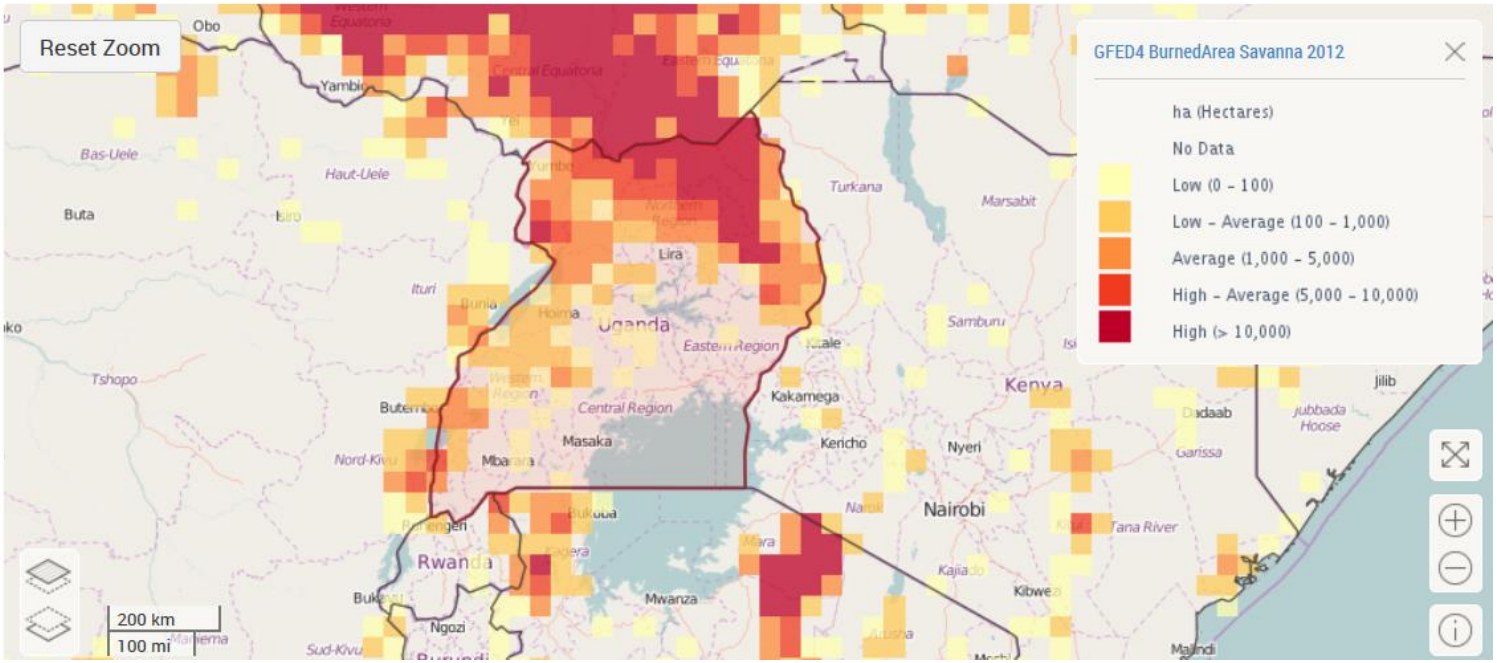
Year

2012

Country

Uganda

Future steps:
Dissemination of spatial data (processed; implied EFs; emission estimates) through FAO GeoNetwork



Emissions Agriculture and Land Use: Data & Metadata & Conceptual notes

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FAOSTAT Domains

- Food Security
- Production
- Trade
- Food Balance
- Prices
- Inputs
- Population
- Investment
- Macro-Statistics
- Agri-Environmental Indicators
- Emissions - Agriculture
- Emissions - Land Use
  - Land Use Total
  - Forest Land
  - Cropland
  - Grassland
  - Burning - Biomass
- Forestry

Metadata / Emissions - Land Use

FAOSTAT data is organized in domains. Please find below the list of available domains for this group: select one of the boxes to access the data.

Land Use Total | Forest Land | Cropland | Grassland | Burning - Biomass

INDEX

The FAOSTAT Emissions Land Use database provides country-level estimates of greenhouse gas (GHG) emissions based on FAOSTAT activity data using Tier 1 computations, following 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National GHG Inventories. Technical details of specific activity data used and relevant computational steps employed, including the mapping between IPCC and FAOSTAT land use categories, are given in the Methodology and Quality Information section of the metadata for each of the sectors in the domain.

Changes in carbon stocks and ecosystem function linked to anthropogenic activities such as land-use change and land management determine emissions and removals of GHG that are typically reported by countries under the IPCC Land Use, Land-Use Change and Forestry (LULUCF) categories. In general, activities that increase terrestrial carbon stocks over time lead to removal of carbon dioxide (CO2) from the atmosphere, while activities that decrease total carbon stocks lead to CO2 and non-CO2 emissions.

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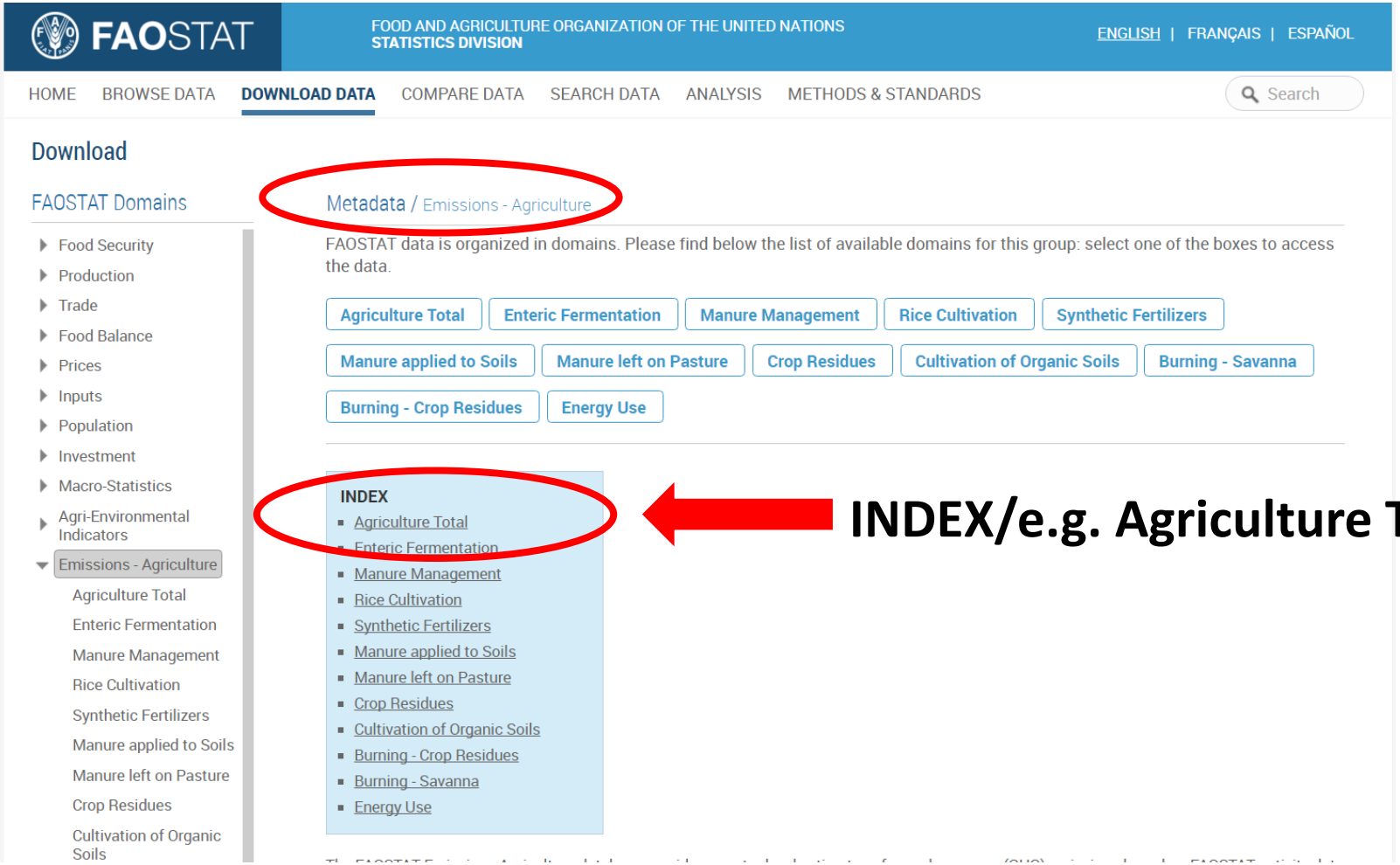
Metadata for the Emissions database (1)

Metadata / methodological notes available for download as pdf for all domains within the Emissions database (Agriculture and Land use)

Download Data/Emissions/Agriculture



INDEX/e.g. Agriculture Total

Metadata for the Emissions database (2)

FAOSTAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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- Inputs
- Population
- Investment
- Macro-Statistics
- Agri-Environmental Indicators
- Emissions - Agriculture
  - Agriculture Total
  - Enteric Fermentation
  - Manure Management
  - Rice Cultivation
  - Synthetic Fertilizers
  - Manure applied to Soils

Agriculture Total

Back

Agriculture Total contains all the emissions produced in the different agricultural emissions sub-domains, providing a picture of the contribution to the total amount of GHG emissions from agriculture. GHG emissions from agriculture consist of non-CO2 gases, namely methane (CH4) and nitrous oxide (N2O), produced by crop and livestock production and management activities. Computed at Tier 1 following IPCC Guidelines for National GHG Inventories; available by country, with global coverage and relative to the period 1990 to present, with annual updates, and projections for 2030 and 2050.

Show Metadata

Show Metadata for Agriculture Total

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Metadata for the Emissions database (3)

Metadata available for download as pdf

Dataset Information:	
Title	**Agriculture Total**
Abstract	Agriculture Total contains all the emissions produced in the different agricultural emissions sub-domains, providing a picture of the contribution to the total amount of GHG emissions from agriculture. GHG emissions from agriculture consist of non-CO_2 gases, namely methane (CH_4) and nitrous oxide (N_2O), produced by crop and livestock production and management activities. Computed at Tier 1 following IPCC Guidelines for National GHG Inventories; available by country, with global coverage and relative to the period 1990-present, with annual updates, and projections for 2030 and 2050.
Supplemental	This domain contains data on GHG emissions and shares on the total GHG emissions from the different agricultural sub-domains. The FAOSTAT Emissions data are estimates by FAO and do not coincide with GHG data reported by member countries to UNFCCC. The database is intended primarily as a service to help member countries assess and report their emissions, as well as a useful international benchmark. The FAOSTAT Emissions data are disseminated publicly to facilitate continuous feedback from member countries.
Creation Date	2012
Last Update	2013
Data Type	Climate Change - Greenhouse Gases
Category	Environment
Time Period	1961-present; projections for 2030 and 2050
Periodicity	Annual
Geographical Coverage	World
Spatial Unit	Country
Language	Multilingual (EN, FR, ES)

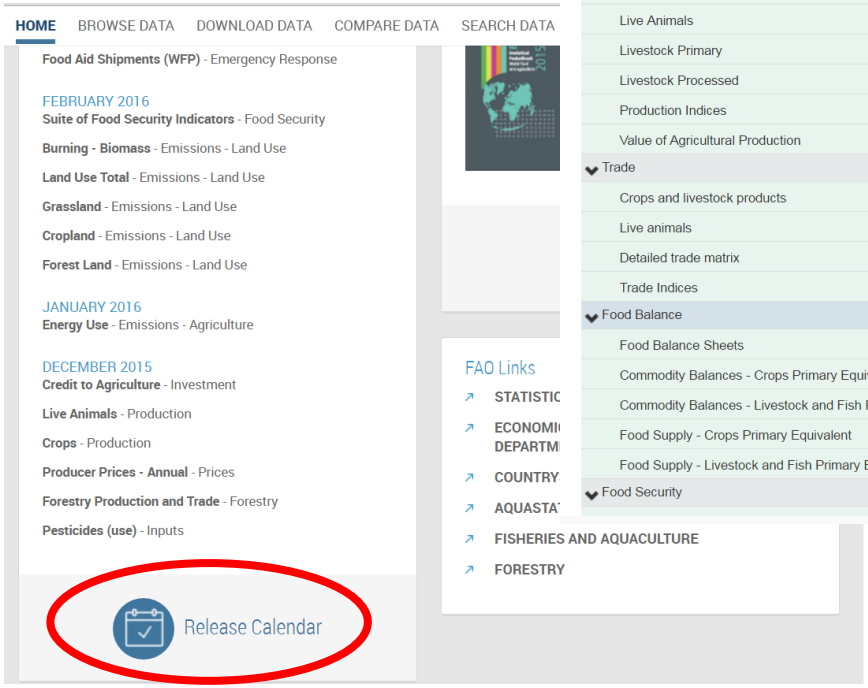
Methodology and Quality Information:	
Methods and processing	Agriculture Total contains all the emissions produced in the different agricultural emissions sub-domains. GHG emissions from agriculture consist of non-CO_2 gases, namely methane (CH_4) and nitrous oxide (N_2O), produced by aerobic and anaerobic decomposition processes in crop and livestock production and management activities. Computed at Tier 1 following IPCC Guidelines for National GHG Inventories.

Data and associated metadata are yearly updated based on the release calendar

FAOSTAT Release Calendar

- Relevant to all domains in FAOSTAT;
- Particularly important for the Emissions database since activity data are mostly drawn from other domains (e.g. Production or Inputs/Land)

FAOSTAT Home page



Release Calendar — Download to Excel

Domain	Last Release / Revision	Data Status	Reference Year	Next Release	Reference Year	Data Status	Focal Point
Production							
Crops	2015-12-17	preliminary	2014	2016-03-31	2014	final	FAOSTAT@fao.org
Crops processed	2015-02-04	final	2013	2016-03-31	2014	final	FAOSTAT@fao.org
Live Animals	2015-12-17	preliminary	2014	2016-03-31	2014	final	FAOSTAT@fao.org
Livestock Primary	2015-02-04	final	2013	2016-03-31	2014	final	FAOSTAT@fao.org
Livestock Processed	2015-02-04	final	2013	2016-03-31	2014	final	FAOSTAT@fao.org
Production Indices	2015-02-04	final	2013	2016-03-15	2014	final	FAOSTAT@fao.org
Value of Agricultural Production	2015-08-31 / 2015-11-09	final	2013	2016-03-15	2014	final	FAOSTAT@fao.org
Trade							
Crops and livestock products	2015-12-11	preliminary	2013	2016-03-31	2013	final	FAOSTAT@fao.org
Live animals	2015-12-11	preliminary	2013	2016-03-31	2013	final	FAOSTAT@fao.org
Detailed trade matrix	2015-12-11	preliminary	2013	2016-03-31	2013	final	FAOSTAT@fao.org
Trade Indices	2015-12-11	preliminary	2013	2016-03-31	2013	final	FAOSTAT@fao.org
Food Balance							
Food Balance Sheets	2015-04-23 / 2015-09-29	preliminary	2013	2016-06-30	2013	final	FAOSTAT@fao.org
Commodity Balances - Crops Primary Equivalent	2015-04-23 / 2015-09-29	preliminary	2013	2016-06-30	2013	final	FAOSTAT@fao.org
Commodity Balances - Livestock and Fish Primary Equivalent	2015-04-23 / 2015-09-29	preliminary	2013	2016-06-30	2013	final	FAOSTAT@fao.org
Food Supply - Crops Primary Equivalent	2015-04-23 / 2016-02-02	preliminary	2013	2016-06-30	2013	final	FAOSTAT@fao.org
Food Supply - Livestock and Fish Primary Equivalent	2015-04-23 / 2016-02-02	preliminary	2013	2016-06-30	2013	final	FAOSTAT@fao.org
Food Security							

Background material / Notes (1)

United Nations
Framework Convention on
Climate Change

Definitions
http://unfccc.int/ghg_data/online_help/definitions/items/3817.php

1) **Activity data:** Activity data, according to the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, are defined as data on the magnitude of human activity resulting in emissions or removals taking place during a given period of time.

2) **Emission factors:** An emission factor is defined as the average emission rate of a given GHG for a given source, relative to units of activity.

Background material / Notes (2)

2) FAO Global Forest Resources Assessments (**GFRA**):
http://www.fao.org/forest-resources-assessment/en/

3) Layer of Climatic Zone developed by the Joint Research Centre (**JRC**) of the European Commission https://ec.europa.eu/jrc/ in Support to the Renewable Energy Directive
http://esdac.jrc.ec.europa.eu/content/support-renewable-energy-directive#tabs-0-description=1
the climate zone layer is defined based on the classification of the IPCC (IPCC, 2006). The zones are defined by a set of rules based on:

- annual mean daily temperature;
- total annual precipitation;
- total annual potential evapo-transpiration (PET);
- elevation

Background material / Notes (3)

4) Recently published article on global emission estimates for **drained organic soils** (Tubiello et al., 2016)
Sustainability 2016, *8*(4), 371; doi:10.3390/su8040371
http://www.mdpi.com/2071-1050/8/4/371
details the methodology for emission estimates from drained organic soils under cropland and grassland.

5) Global Land Cover 2000 (GLC 2000) JRC of the European Commission
http://forobs.jrc.ec.europa.eu/products/glc2000/products.php
User and producer accuracies in Mayaux et al., 2006. Validation of the global land cover 2000 map IEEE Transactions on Geoscience and Remote Sensing (Volume 44, Issue 7).

Background material / Notes (4)

6) Gridded Livestock of the World source for livestock distribution. **GLW 2007**
http://www.fao.org/docrep/010/a1259e/a1259e00.HTM
used for current estimates of emissions from organic soils under grassland cover. Corresponding data layers and updates (GLW 2) available in FAO GeoNetwork
http://www.fao.org/geonetwork/srv/en/main.home
and in the Livestock Geo-Wiki http://livestock.geo-wiki.org/
Robinson et al., 2014 in PlosOne
Mapping the Global Distribution of Livestock
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0096084

Background material / Notes (5)

7a) The Global Fire Emissions Database (GFED4, Giglio et al., 2013 http://onlinelibrary.wiley.com/doi/10.1002/jgrg.20042/abstract Provides global monthly burned areas at 0.25° spatial resolution from mid-1995 through the present. In the FAO emissions database average values for the period 1996 to present days are used to complete the period 1990 to 1995.

The GFED4 is based on MODIS data. Moderate Resolution Imaging Spectroradiometer (MODIS) http://modis.gsfc.nasa.gov/about/ is a key instrument aboard the Terra and Aqua satellites.

Background material / Notes (6)

7b) For the domain Emissions Land Use/Burning biomass and the categories: **Humid Tropical Forest** and **Other Forest**, the GFED4 burned areas is an aggregate of burned area in the following **MODIS land cover classes** (**MCD12Q1**): http://glcf.umd.edu/data/lc/
"Evergreen Needle-leaf", "Evergreen Broadleaf"; "Deciduous Needle-leaf"; "Deciduous Broadleaf"; and "Mixed Forest".

More specifically, the "**Humid Tropical Forest**" burned area is obtained by overlapping (spatially) the GFED burned forest area in the above forest categories with the "Tropical rainforest" and "Tropical moist deciduous forest" as defined in the **FAO-FRA Global Ecological Zones**
http://www.fao.org/docrep/017/ap861e/ap861e00.pdf
and corresponding raster data available for download in FAO GeoNetwork
http://www.fao.org:80/geonetwork?uuid=2fb209d0-fd34-4e5e-a3d8-a13c241eb61b
The burned area for the categories "**Other forest**" is obtained as GFED4 total burned forest area minus the Humid Tropical Forest burned area defined earlier.

Analyses supported by the FAOSTAT Emissions Database

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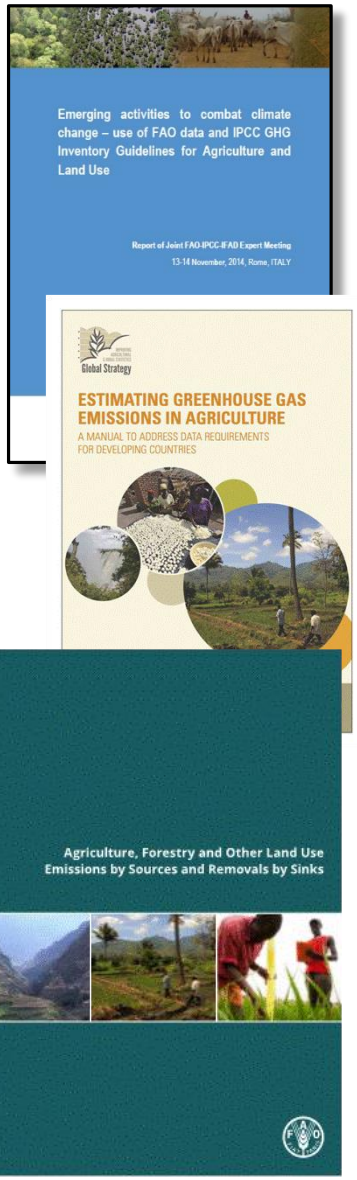
FAO emissions database: Addressing different data analysis needs

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. **<u>Access geo-referenced data</u>** Move beyond nationally aggregated statistics for the land use sector;



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FAOSTAT Emissions Database:
Assessing Global Trends across key AFOLU categories

Average AFOLU emissions (sources and sinks) 2001-2010 (Mt CO_2eq yr^{-1})

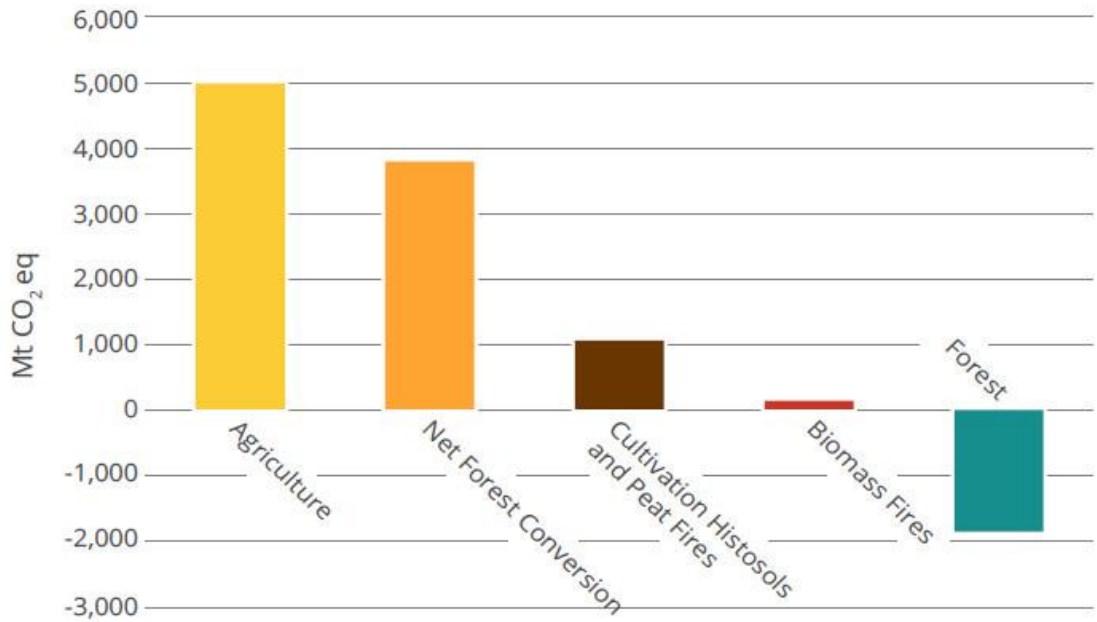
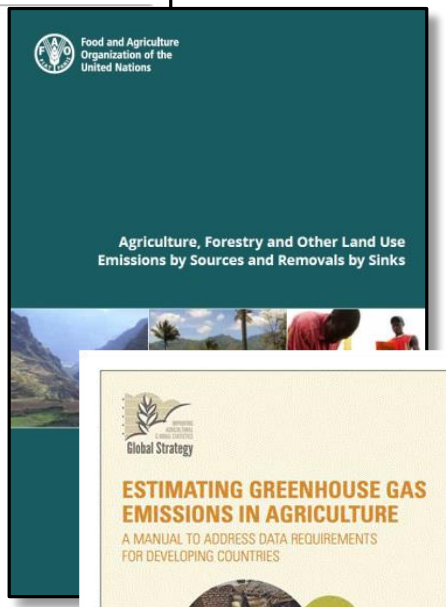
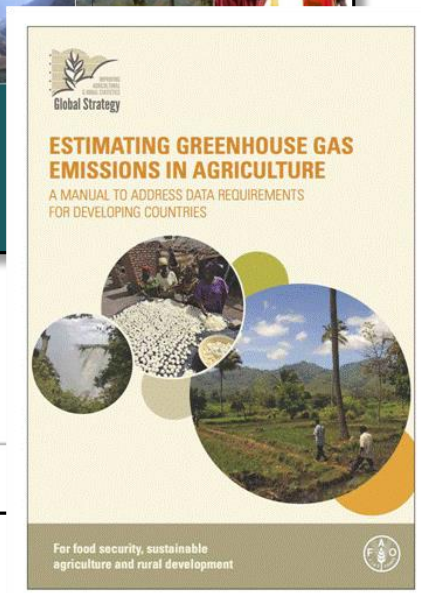


FIGURE 3-2 AFOLU sources and sinks by sub-sector, 2001-2010





http://www.fao.org/3/a-i3671e.pdf

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FAOSTAT Emissions Database:
Assessing Global Trends across key AFOLU categories

Average AFOLU emissions (sources and sinks) 2001-2010 (Mt CO_2eq yr^{-1})

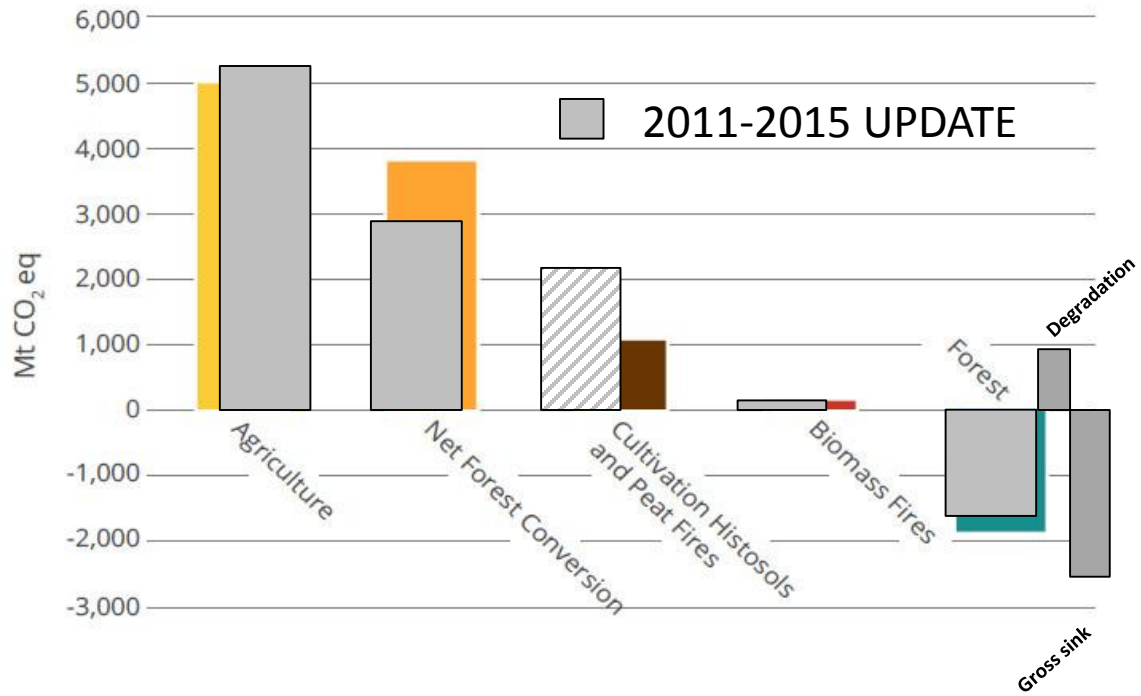
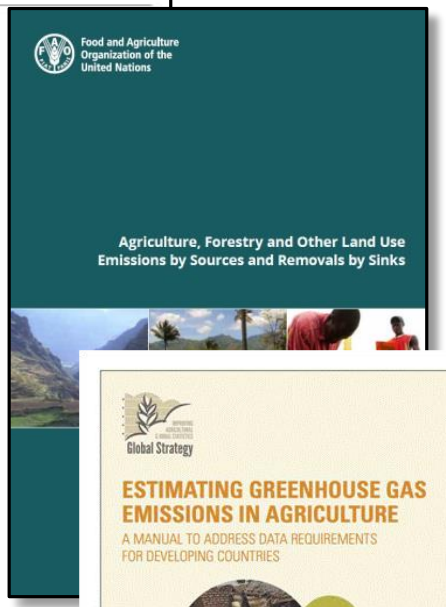
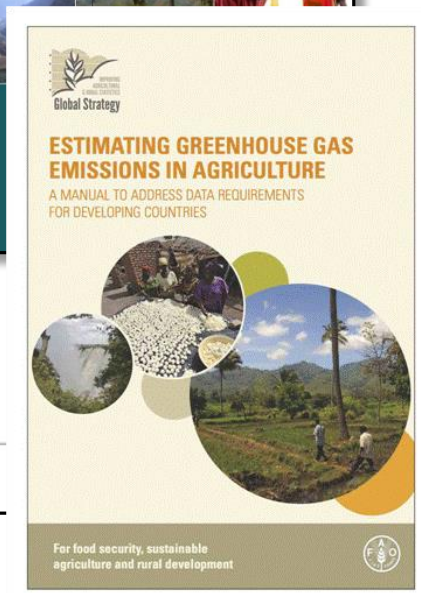


FIGURE 3-2 AFOLU sources and sinks by sub-sector, 2001-2010





http://www.fao.org/3/a-i3671e.pdf

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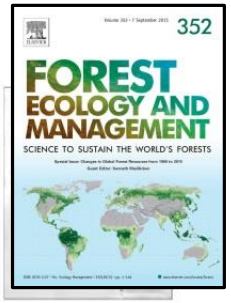
Emissions from Deforestation sharply reduced, but those from Forest degradation increase

Forest Ecology and Management 352 (2015) 89–98

Contents lists available at ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco



New estimates of CO_2 forest emissions and removals: 1990–2015 ☆

Sandro Federici [a], Francesco N. Tubiello [a,b,*], Mirella Salvatore [a], Heather Jacobs [a], Josef Schmidhuber [b]

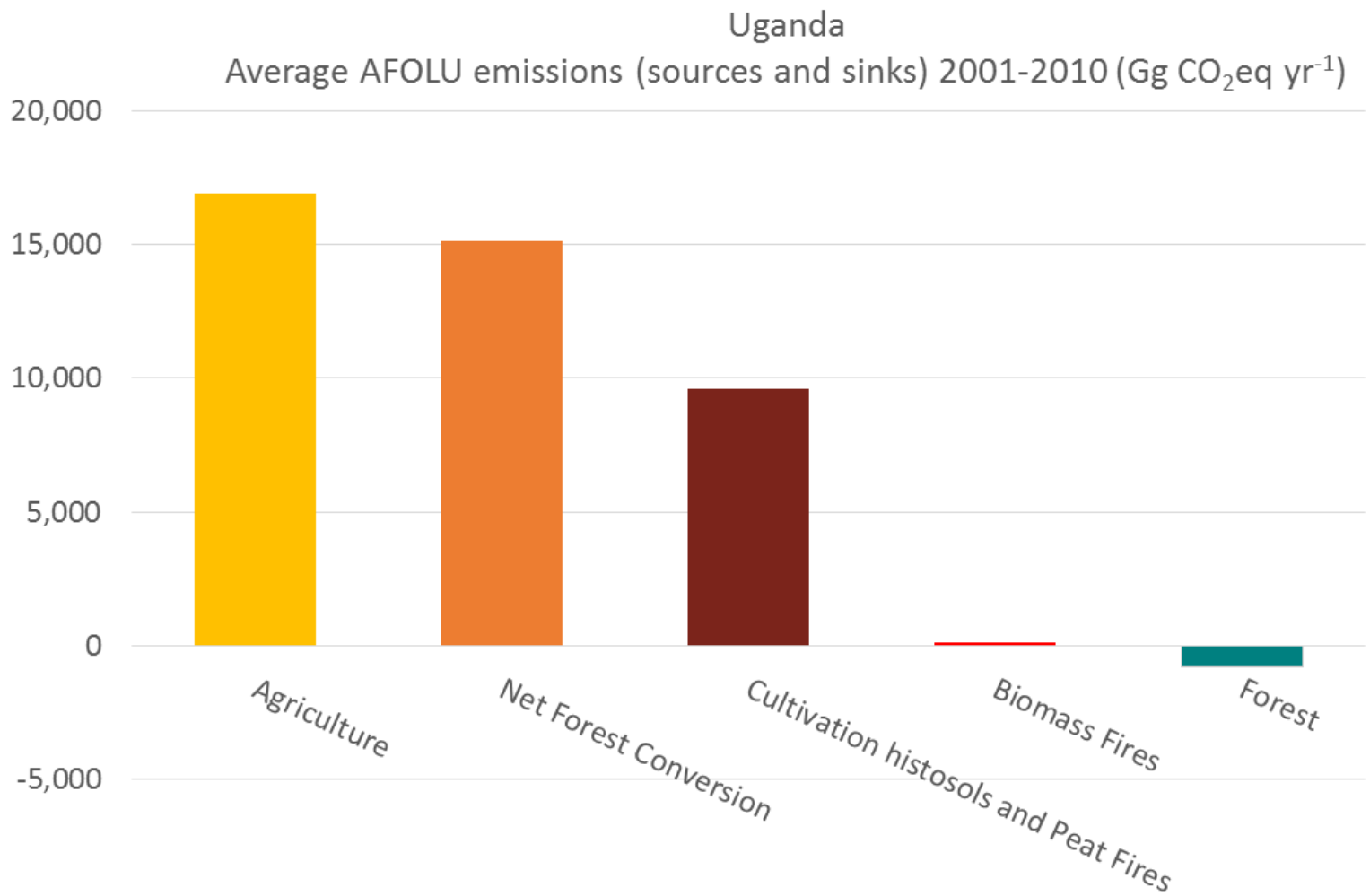
[a] Climate, Energy and Tenure Division, Food and Agriculture Organization of the United Nations, Via Terme di Caracalla, Rome 00153, Italy
[b] Statistics Division, Food and Agriculture Organization of the United Nations, Via Terme di Caracalla, Rome 00153, Italy

New emissions estimations using the method of FAOSTAT Emissions database and the newly available 2015 Forest Resources Assessment (FRA) data:

- Emissions from net forest conversion (a proxy for **deforestation**) have decreased from an average of ≈ 4 Gt CO_2 yr^{-1} during 2001-2010 to ≈ 3 Gt CO_2 yr^{-1} during 2011-2015.
- In contrast, the global net forest sink has reduced, with emissions from its **forest degradation** component, assessed separately for the first time in FAOSTAT, showing a notable increment, from 0.4 Gt CO_2 yr^{-1} in 1990s to ≈ 1 Gt CO_2 yr^{-1} in 2001-2015.
- Forest (net forest conversion + forest sink) remains a net source of CO_2, but a lower one in 2011-2015.

http://www.sciencedirect.com/science/article/pii/S0378112715002443

FAOSTAT Emissions Database:
Assessing Trends across key AFOLU categories: Uganda



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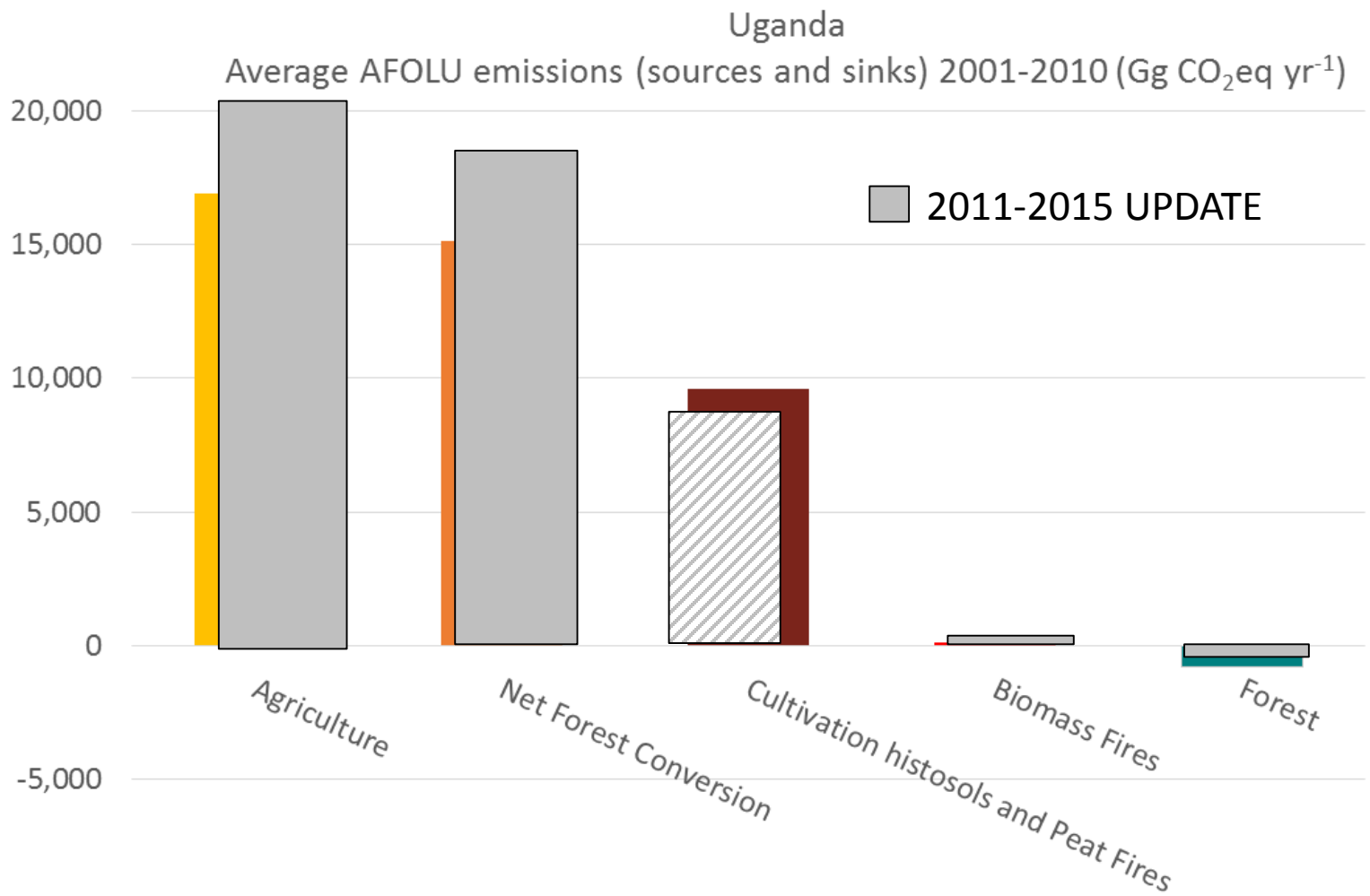
FAOSTAT Emissions Database:
Assessing Trends across key AFOLU categories: Uganda



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Comparing data, analyzing trends

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Emissions - Land Use	Forest Land	Uganda	Forest land	Area

AREA	Uganda
ITEM	Forest land
ELEMENT	Area

Inputs - Land summary

GROUP	DOMAIN	AREA	ITEM	ELEMENT
Inputs	Land	Uganda	Agricultural area	Area

AREA	Uganda
ITEM	Agricultural area
ELEMENT	Area

1990 — 2010

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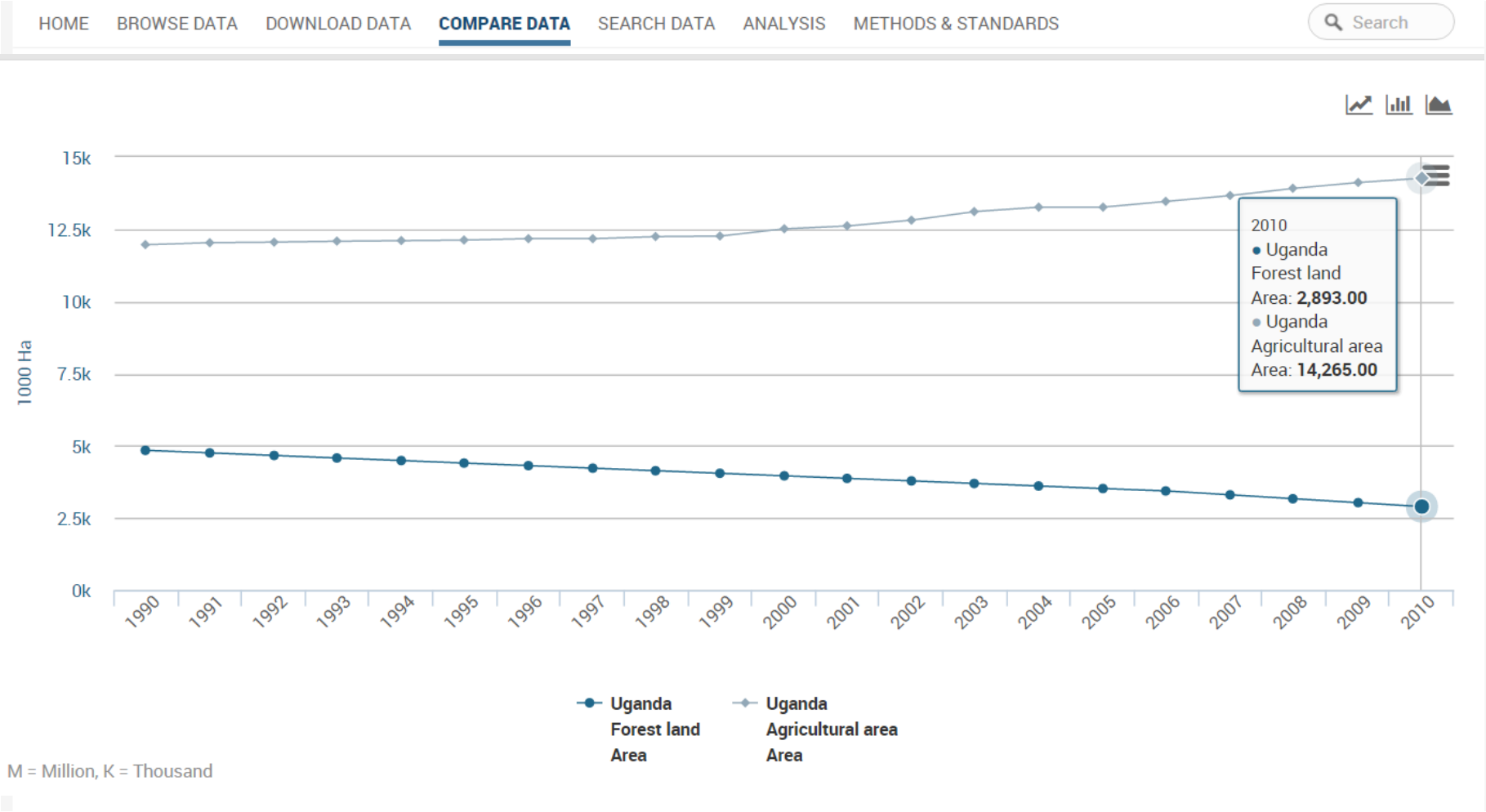

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Food and Agriculture Organization of the United Nations

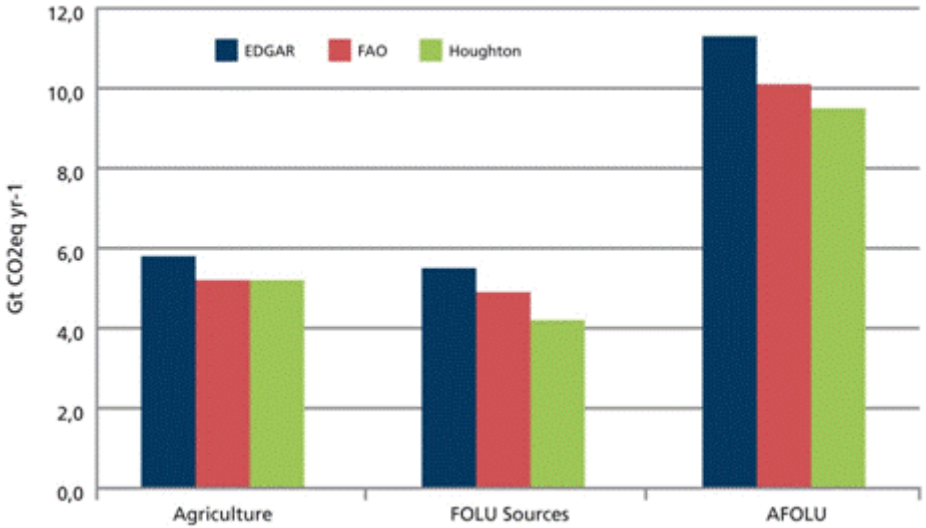
Global Change Biology (2015), doi: 10.1111/gcb.12865

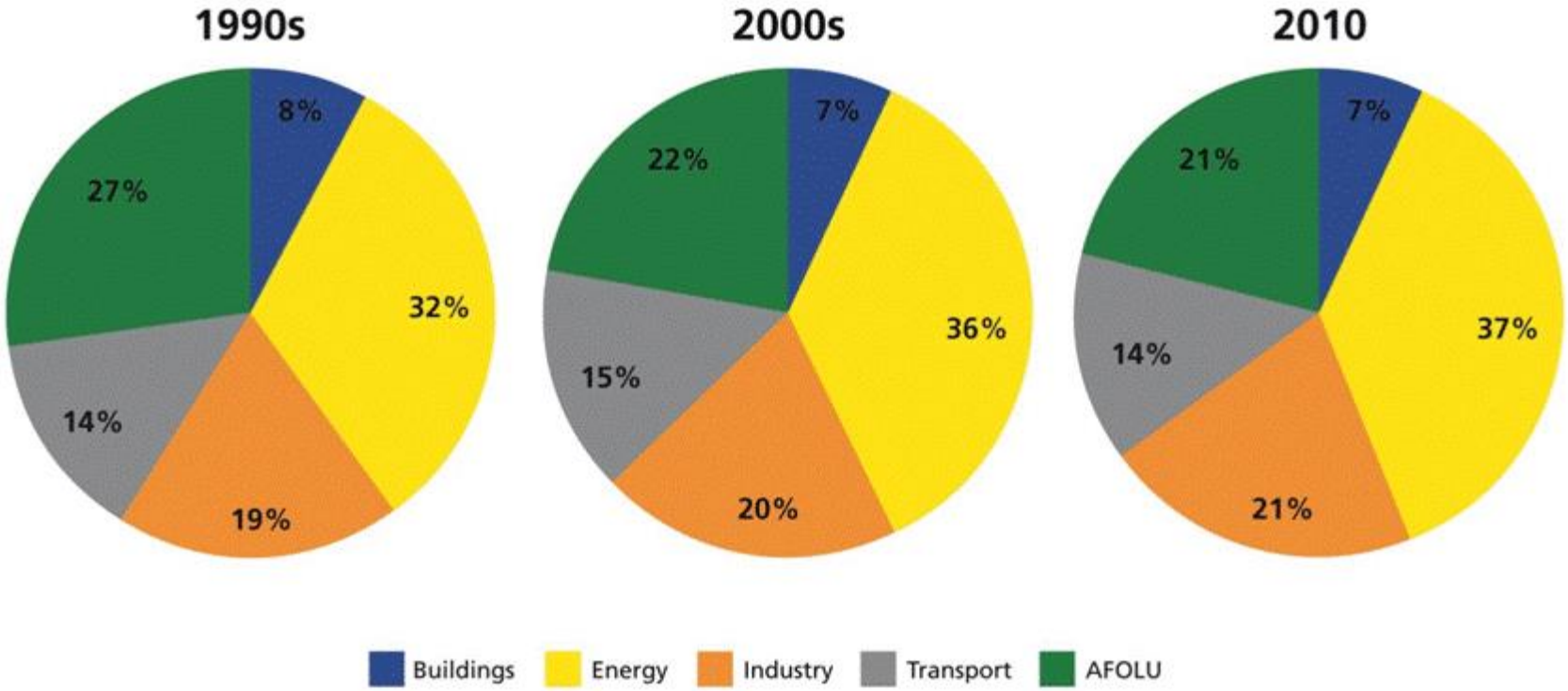
The Contribution of Agriculture, Forestry and other Land Use activities to Global Warming, 1990–2012

FRANCESCO N. TUBIELLO[1], MIRELLA SALVATORE[1], ALESSANDRO F. FERRARA[1], JO HOUSE[2], SANDRO FEDERICI[1], SIMONE ROSSI[1,3], RICCARDO BIANCALANI[1], ROCIO D. CONDOR GOLEC[1], HEATHER JACOBS[1], ALESSANDRO FLAMMINI[1], PAOLO PROSPERI[1], PAOLA CARDENAS-GALINDO[1], JOSEF SCHMIDHUBER[4], MARIA J. SANZ SANCHEZ[5], NALIN SRIVASTAVA[6,7] and PETE SMITH[7]

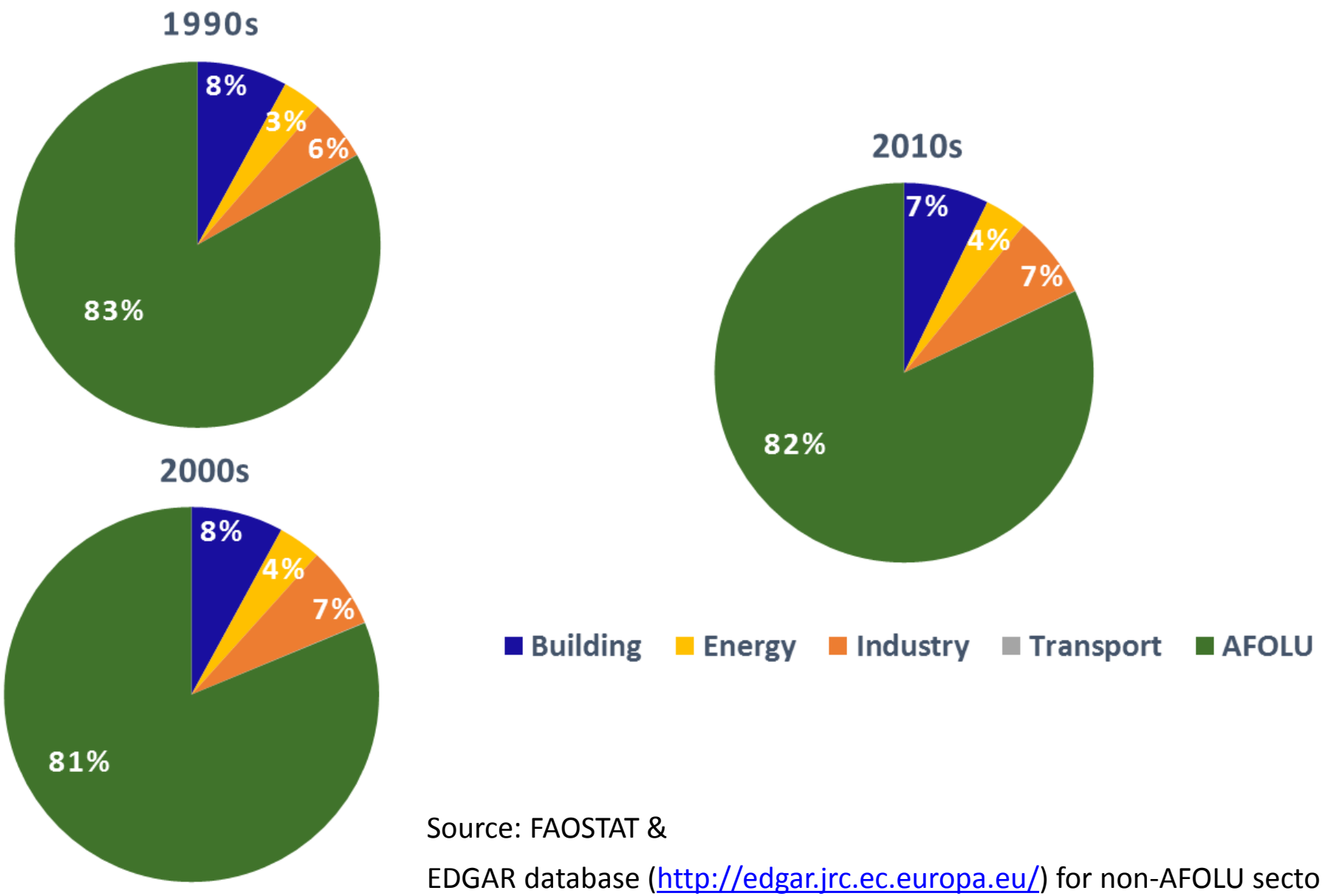
[1]*Climate, Energy and Tenure Division, Food and Agriculture Organization of the United Nations, Via Terme di Caracalla, Rome 00153, Italy,* [2]*School of Geographical Sciences, University of Bristol, University Road, Bristol BS8 1SS, UK,* [3]*European Commission Joint Research Center, Ispra, VA 28100, Italy,* [4]*Statistics Division, Food and Agriculture Organization of the United Nations, Via Terme di Caracalla, Rome 00153, Italy,* [5]*Forest Management Division, Food and Agriculture Organization of the United Nations, Via Terme di Caracalla, Rome 00153, Italy,* [6]*IPCC Task Force on National GHG Inventories, IGES, 2108-11 Kamiyamaguchi Hayama, Kanagawa, Japan,* [7]*Institute of Biological and Environmental Sciences, School of Biological Sciences, University of Aberdeen, 23 St Machar Drive, Room G45, Aberdeen AB24 3UU, UK*

Abstract





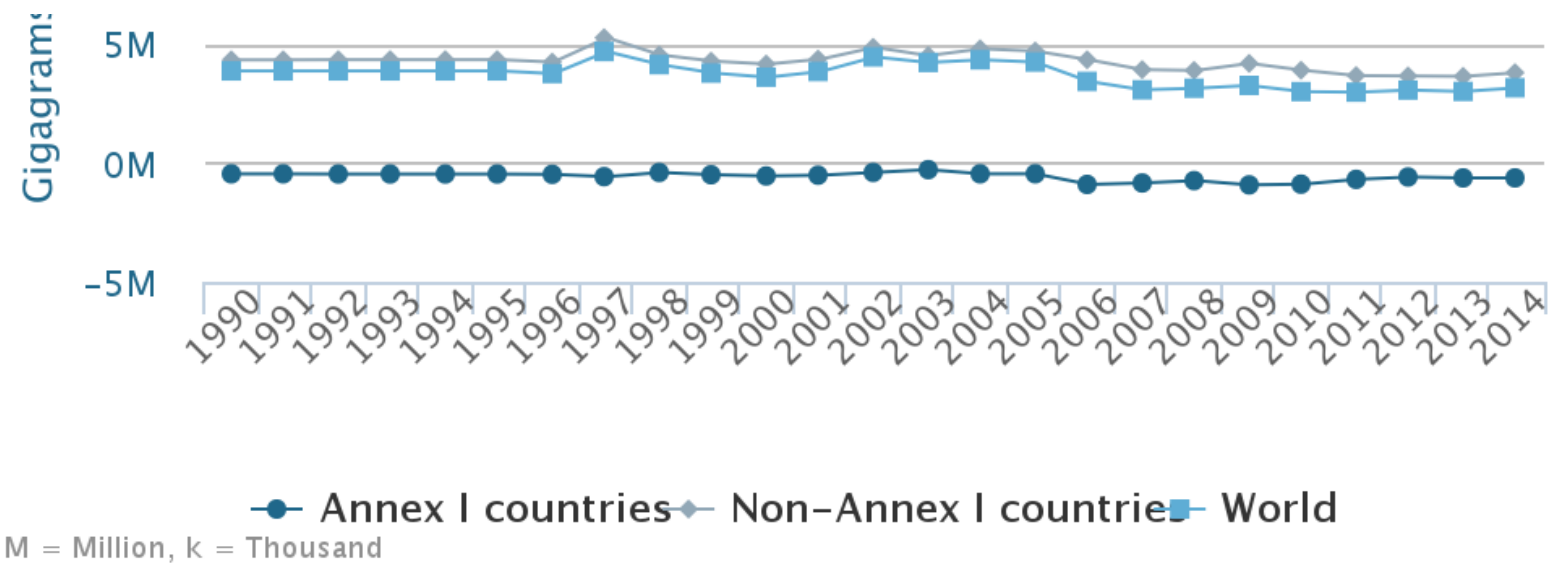
Share of emissions by sector in Uganda



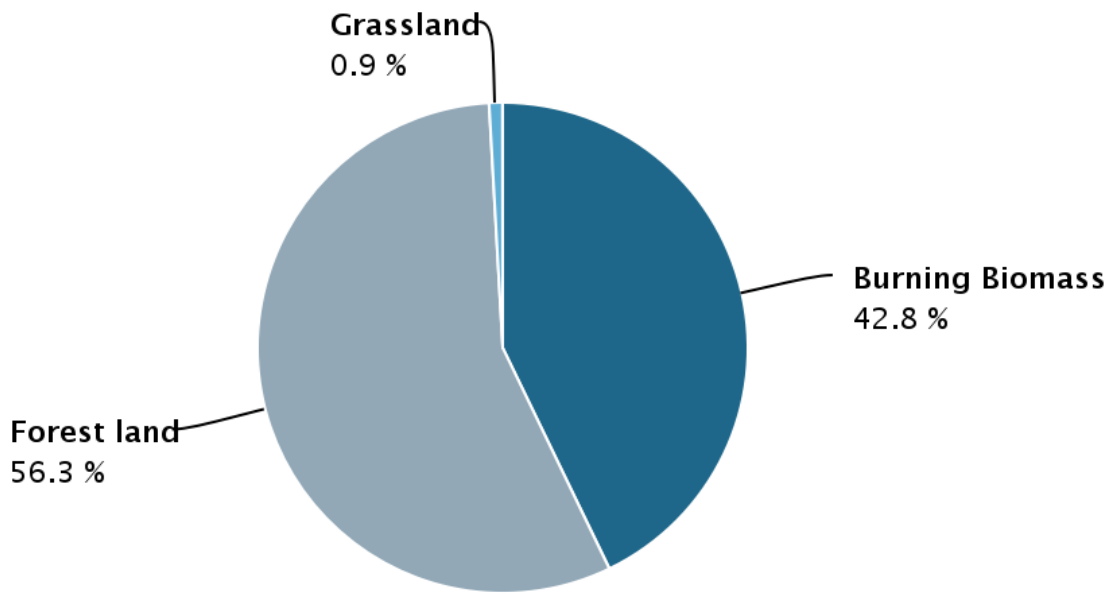
Source: FAOSTAT &

EDGAR database (http://edgar.jrc.ec.europa.eu/) for non-AFOLU sectors

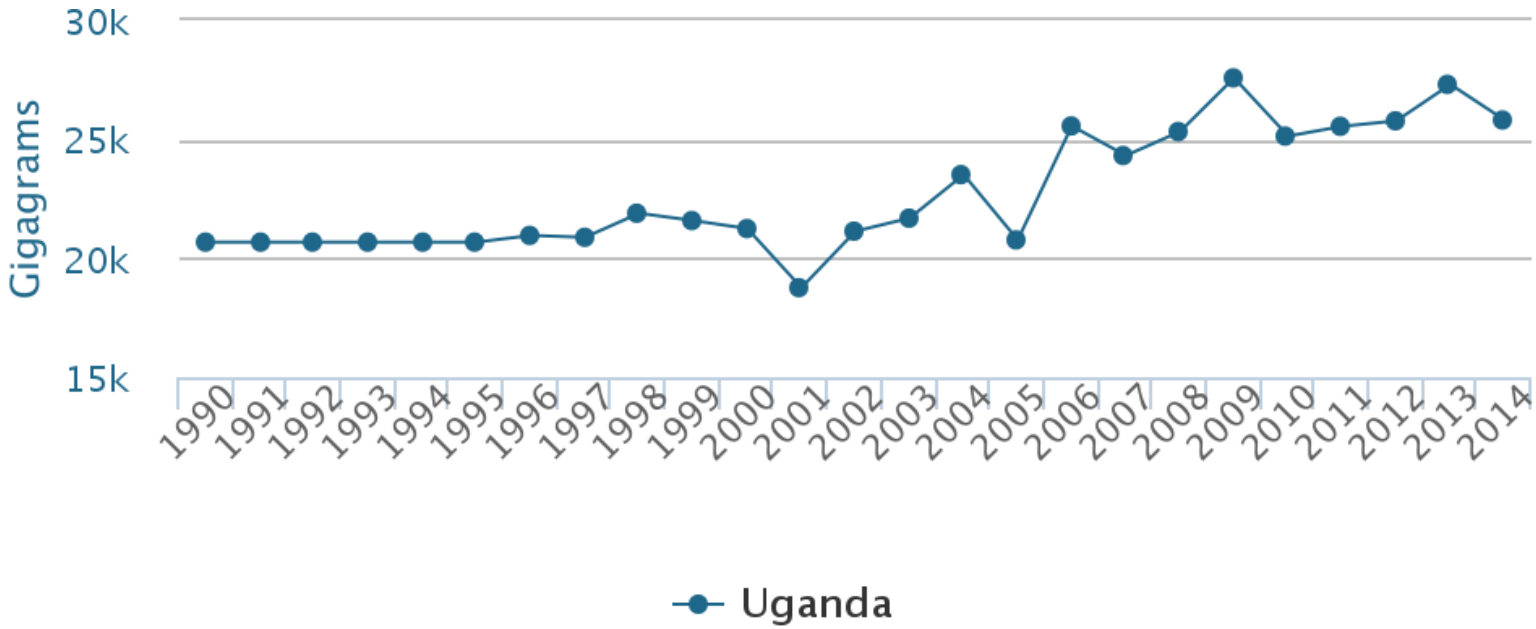
Land Use emissions: global trend and share by category



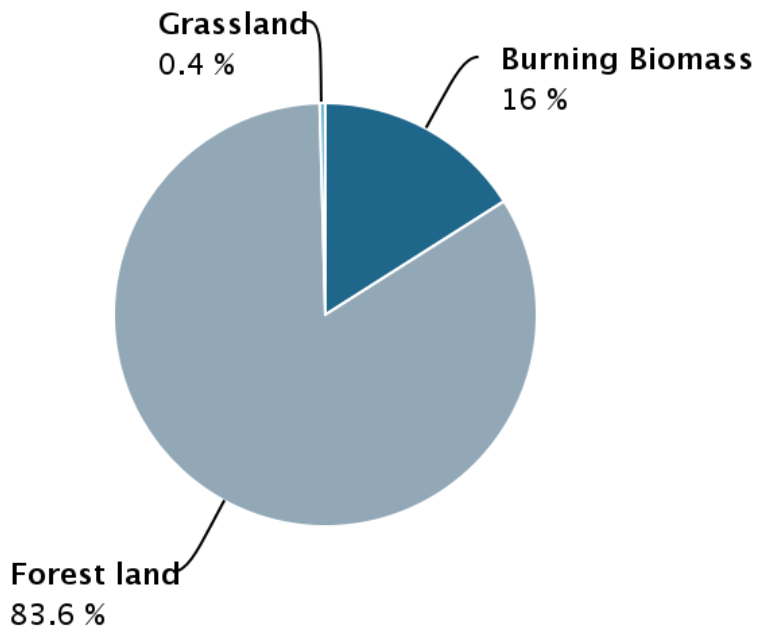
M = Million, k = Thousand



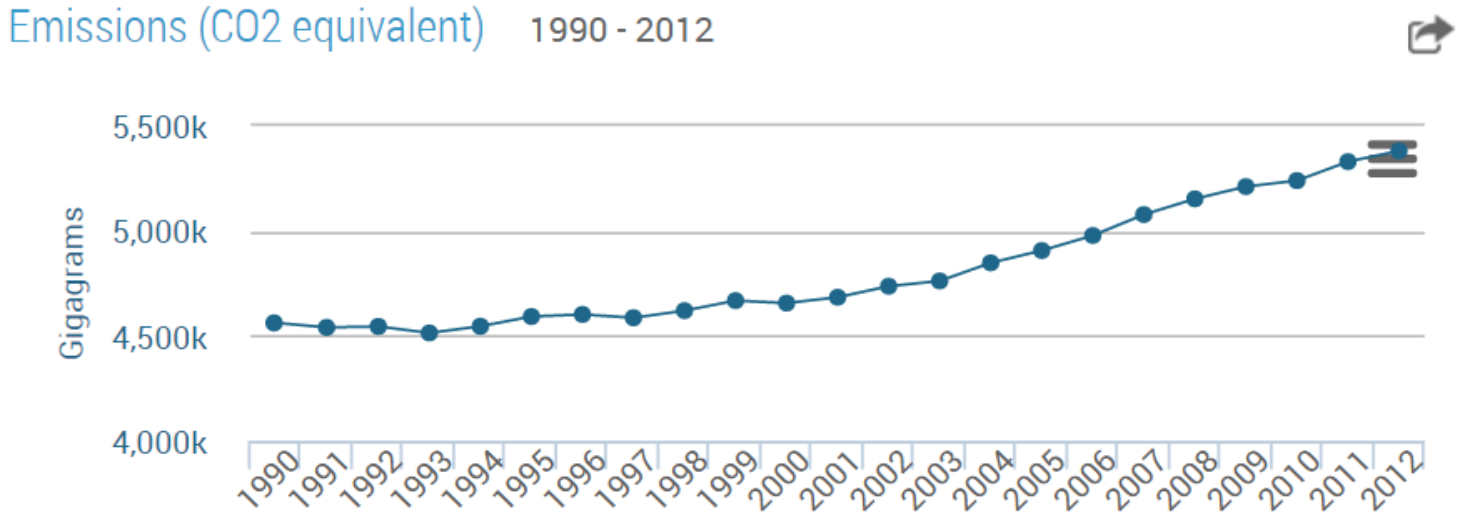
Land Use emissions: trend and share by category Uganda



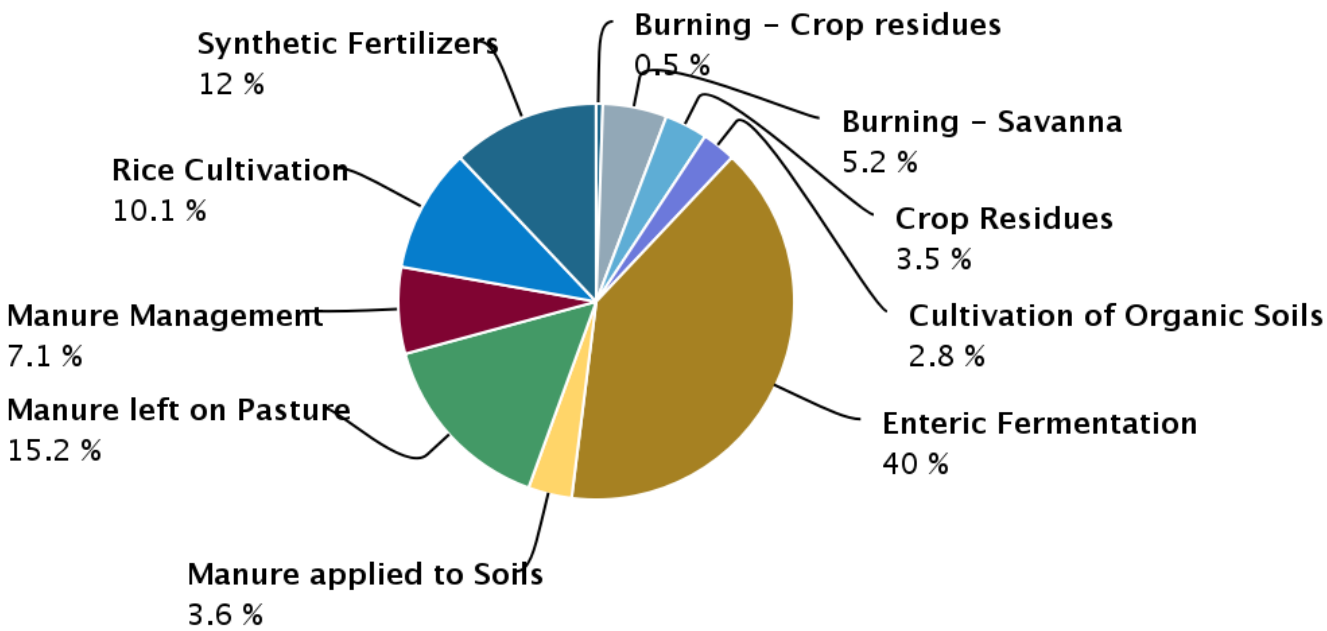
M = Million, k = Thousand



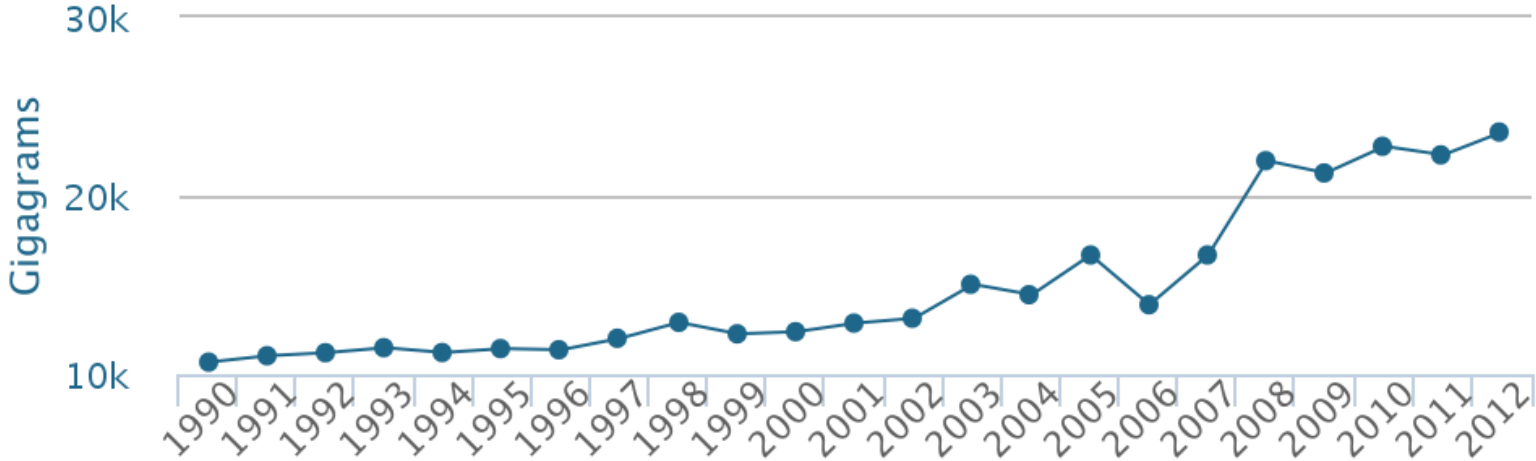
Agriculture emissions: global trend and share by category



M = Million, k = Thousand

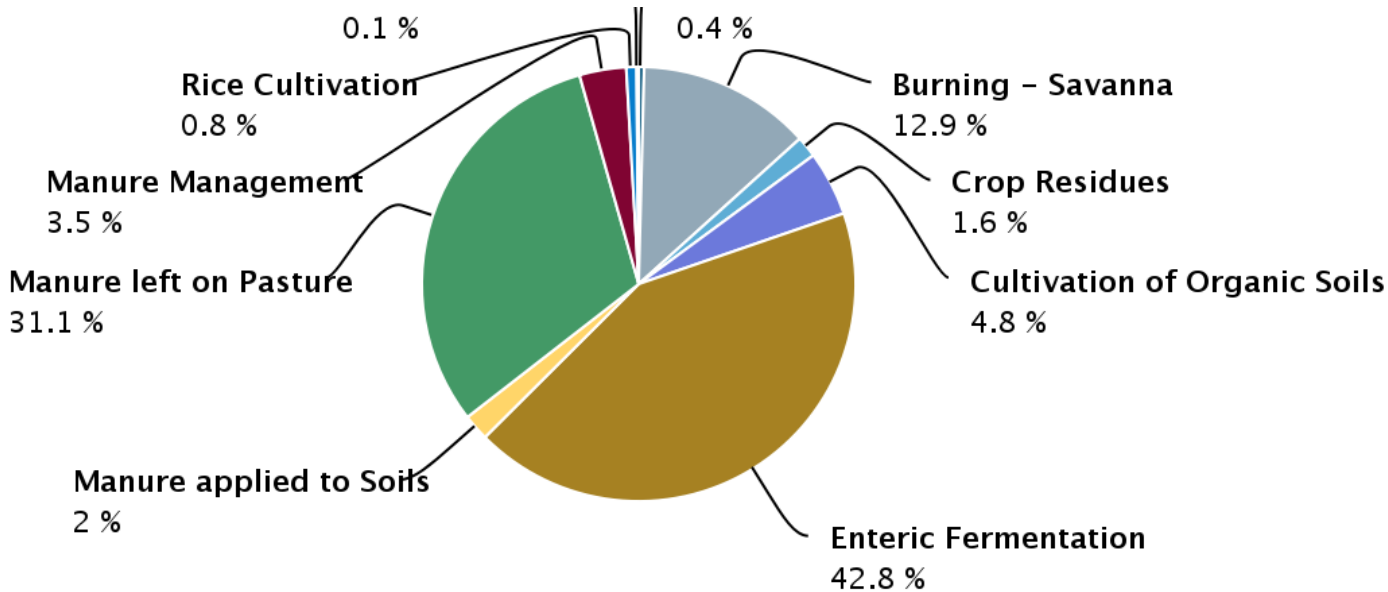


Agriculture emissions: trend and share by category Uganda



Uganda

M = Million, k = Thousand



Emissions Agriculture – Agriculture Projections

- All domains (but Energy) under the Agriculture database report **projections to 2030 and 2050**;

- Activity data from Projections of the FAO Global Perspective Unit (baseline year average of **2005 – 2006 and 2007** (Alexandratos and Bruinsma, 2012): http://www.fao.org/fileadmin/templates/esa/Global_persepctives/world_ag_2030_50_2012_rev.pdf

- Regional / neighboring countries when country values were missing;

- Readily available also from FAOSTAT/Browse Data/Emissions Agriculture/Projections;

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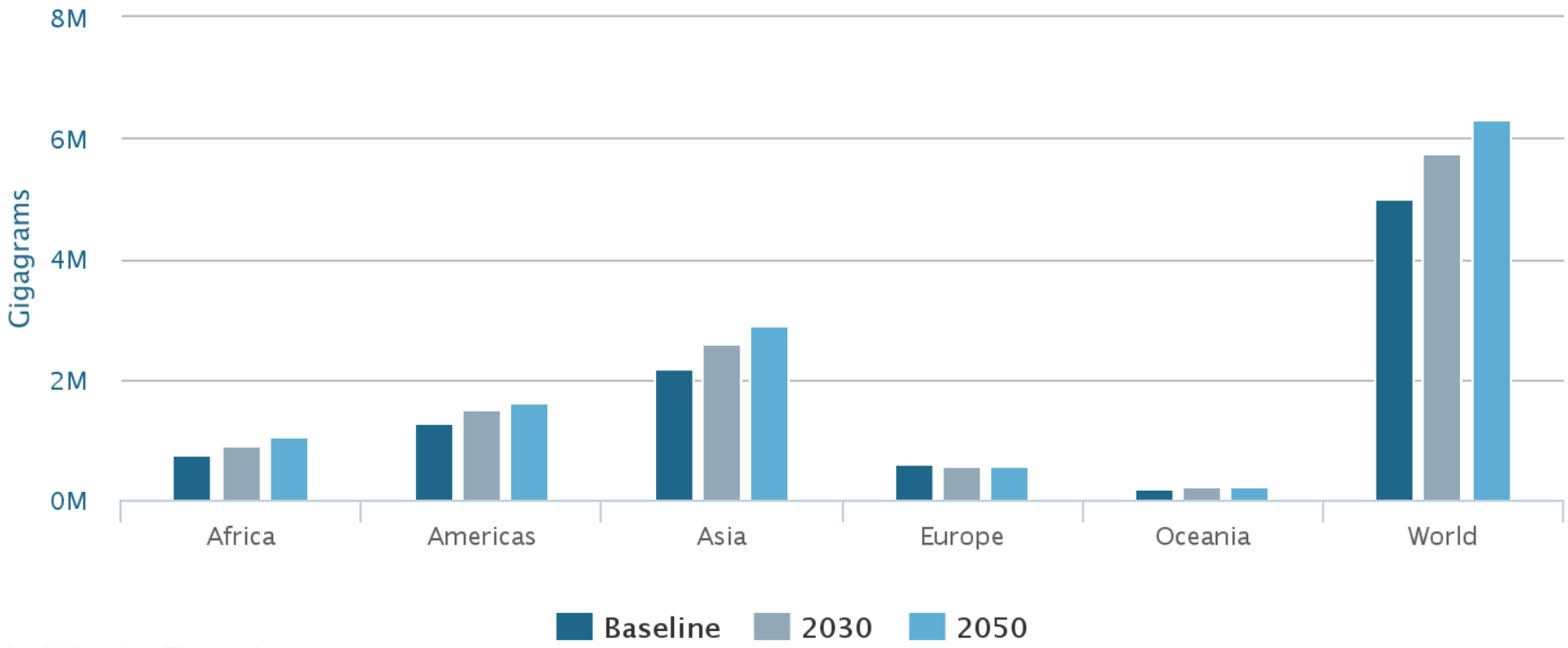
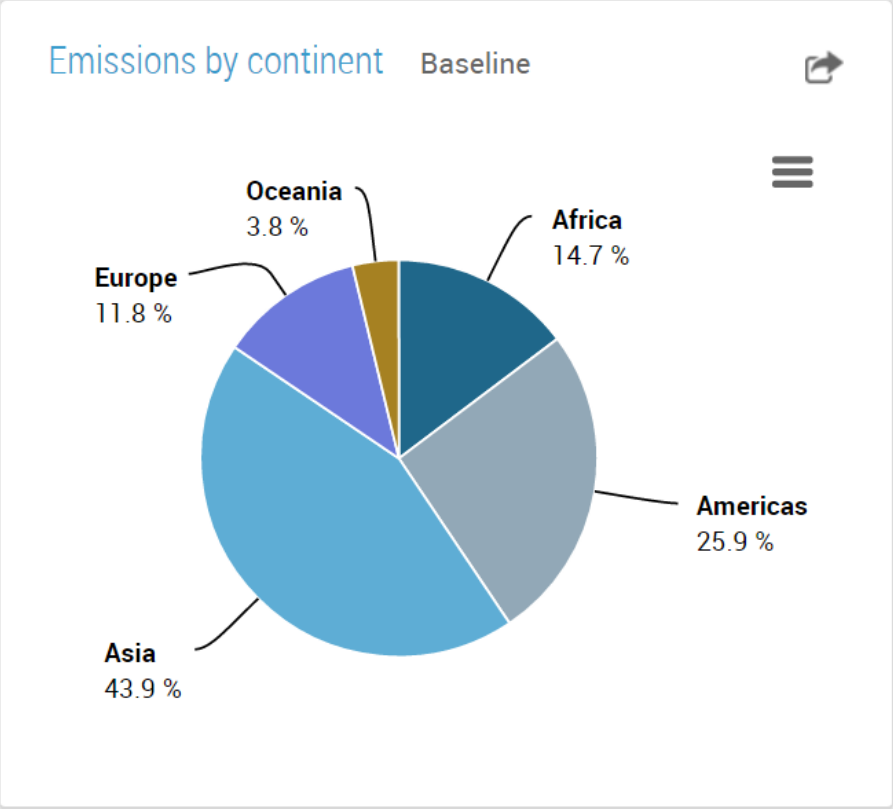
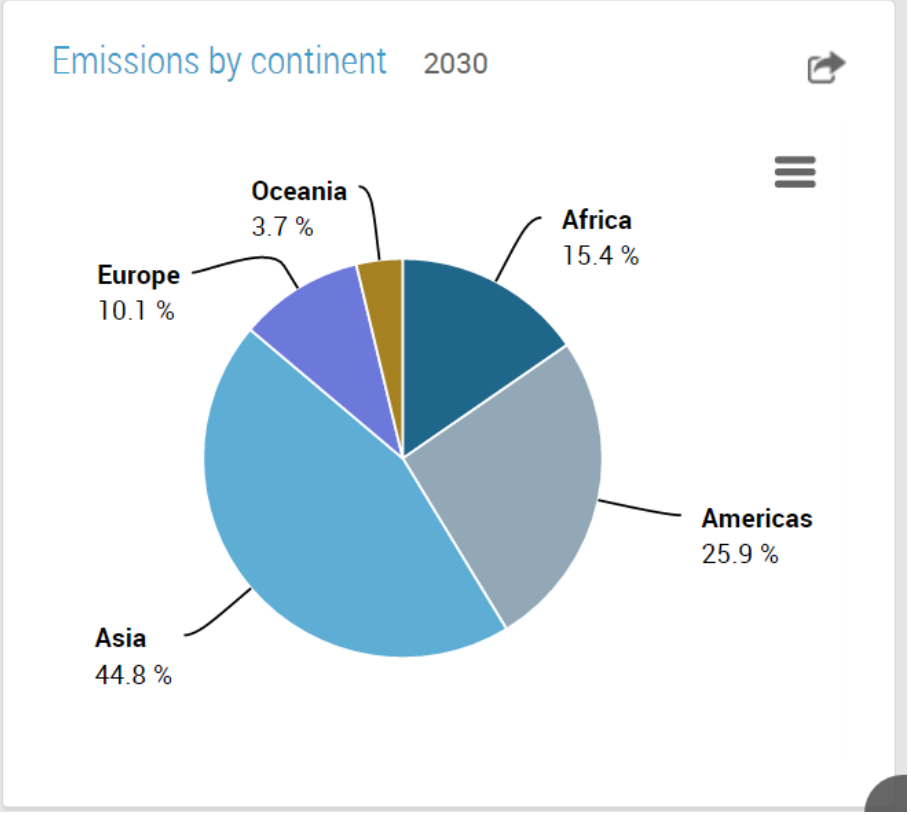
Global Projections – Emissions from Agriculture (2030)



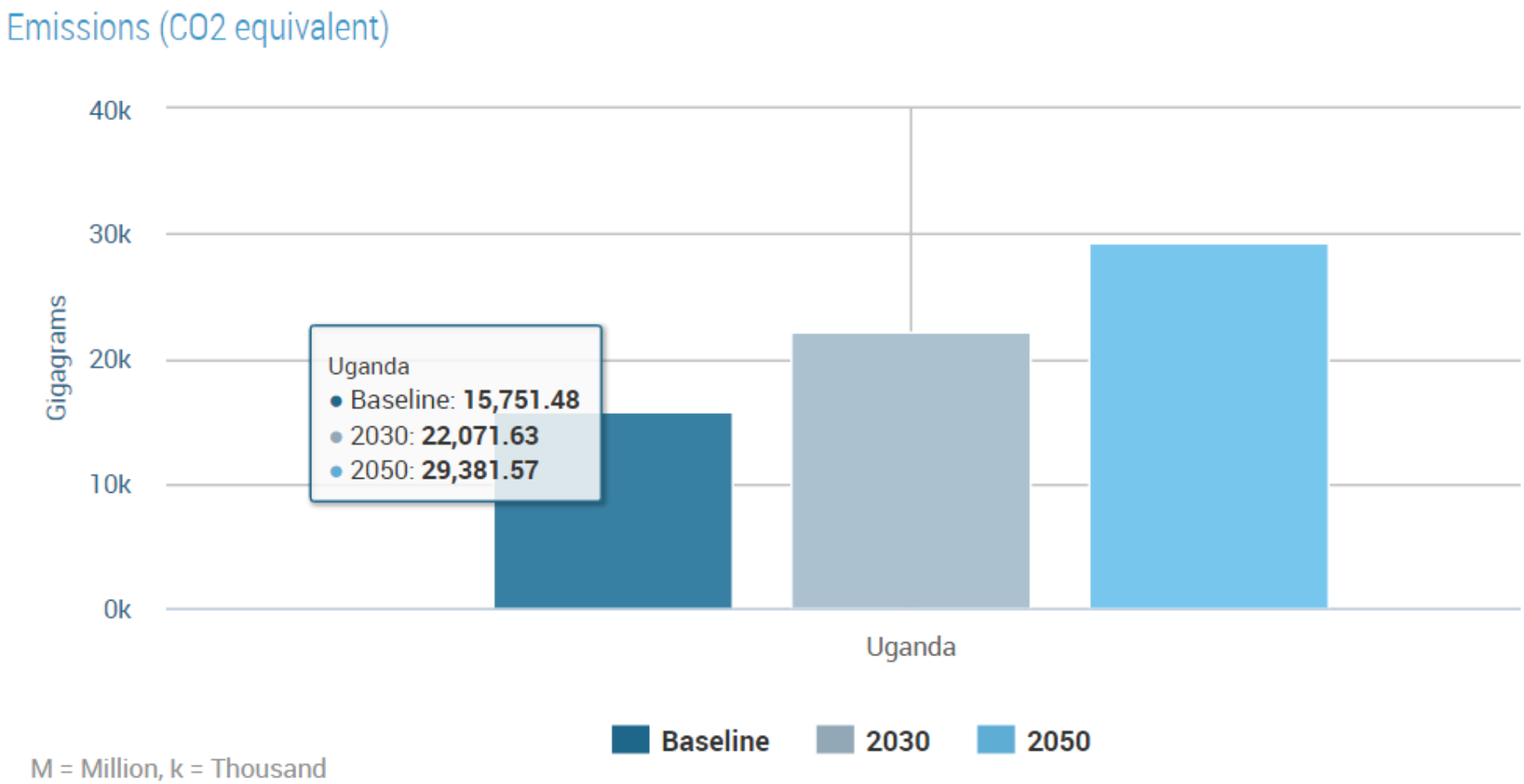
M = Million, k = Thousand

Global Projections – Emissions from Agriculture (2030)





Uganda Projections – Emissions from Agriculture



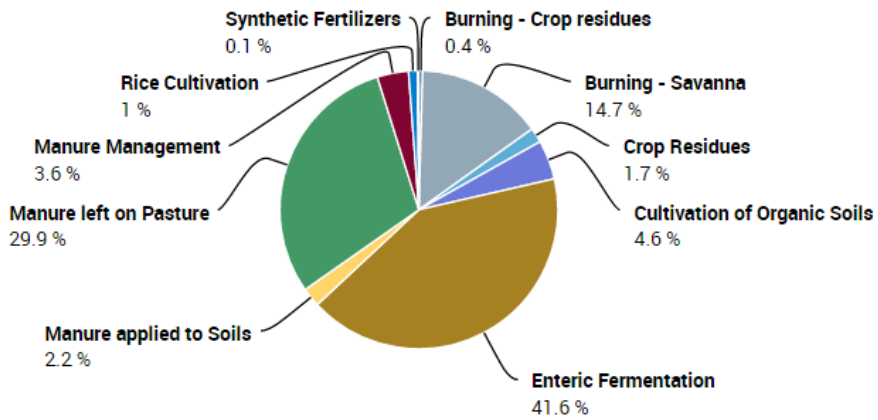
Uganda Projections – Emissions from Agriculture

Emissions - Agriculture

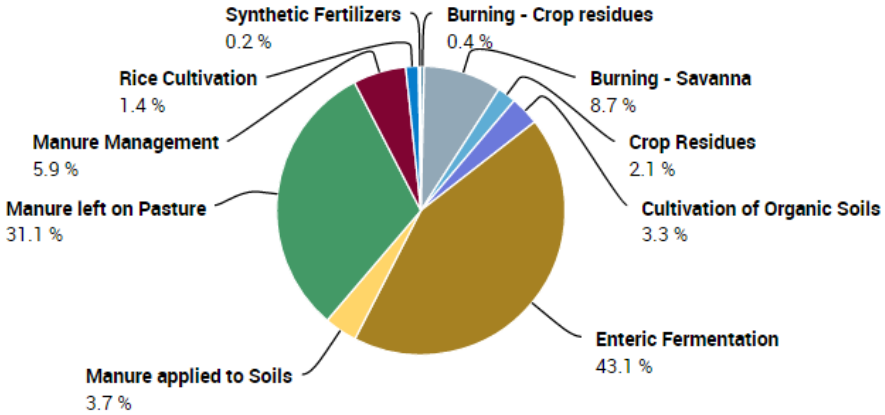
1961-Present | Projections

Emissions of methane and nitrous oxide produced from agricultural activities

ITEM	AREA	YEAR
Agriculture total	Uganda	2030



Emissions by sector 2030



Emissions (

40k

30k

20k

10k

0k

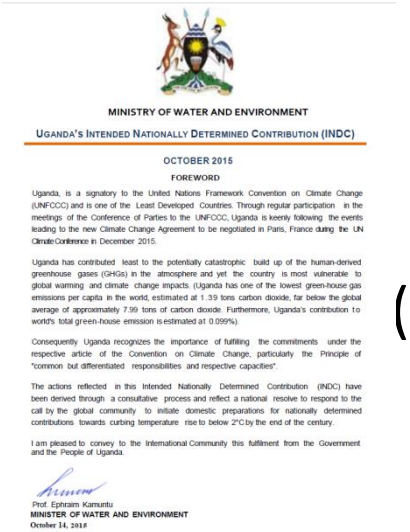
Gigagrams

M = Million,

Uganda INDC 2015

Mitigation measures: CSA for cropping; Livestock breeding and manure management practices

Total emissions



MINISTRY OF WATER AND ENVIRONMENT

UGANDA'S INTENDED NATIONALLY DETERMINED CONTRIBUTION (INDC)

OCTOBER 2015

FOREWORD

Uganda, is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and is one of the Least Developed Countries. Through regular participation in the meetings of the Conference of Parties to the UNFCCC, Uganda is keenly following the events leading to the new Climate Change Agreement to be negotiated in Paris, France during the UN Climate Conference in December 2015.

Uganda has contributed least to the potentially catastrophic build up of the human-derived greenhouse gases (GHGs) in the atmosphere and yet the country is most vulnerable to global warming and climate change impacts. (Uganda has one of the lowest green-house gas emissions per capita in the world, estimated at 1.39 tons carbon dioxide, far below the global average of approximately 7.99 tons of carbon dioxide. Furthermore, Uganda's contribution to world's total green-house emission is estimated at 0.099%).

Consequently Uganda recognizes the importance of fulfilling the commitments under the respective article of the Convention on Climate Change, particularly the Principle of "common but differentiated responsibilities and respective capacities".

The actions reflected in this Intended Nationally Determined Contribution (INDC) have been derived through a consultative process and reflect a national resolve to respond to the call by the global community to initiate domestic preparations for nationally determined contributions towards curbing temperature rise to below 2°C by the end of the century.

I am pleased to convey to the International Community this fulfilment from the Government and the People of Uganda.

Prof. Ephraim Kamuntu
MINISTER OF WATER AND ENVIRONMENT
October 14, 2018

36,500 $GgCO_2eq$/ year in **2000** (INDC 2014);

Approx. 77,300 $GgCO_2eq$/ year in **2030** BAU (INDC 2014);

Cumulative impact could result in **22% reduction** compared to BAU projection;

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Possible use: INDC (for Agriculture)

- Role of agriculture on a BAU scenario **projected to contribute approx. 28% (**22,056 Gg CO_2 of projected 77,300 GgCO_2eq country emissions in 2030);

- Assumed **increased efficiency** (emissions from agriculture estimated to account **45%** of country total emissions) of crop and livestock production systems as incomes raise;

- Expected further decrease of the agricultural share of emissions as a result of adaptation and mitigation interventions in the agricultural sector.

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New Data Analytical Tools based on FAOSTAT: QA/QC

Comparing National Data and FAOSTAT – e.g. from Uganda Total Agriculture

QA-QC and Verification

User Instructions

http://www.fao.org/in-action/micca/resources/tools/ghg/qaqc-verification/en/

Go back to the tools main page

Country: Uganda

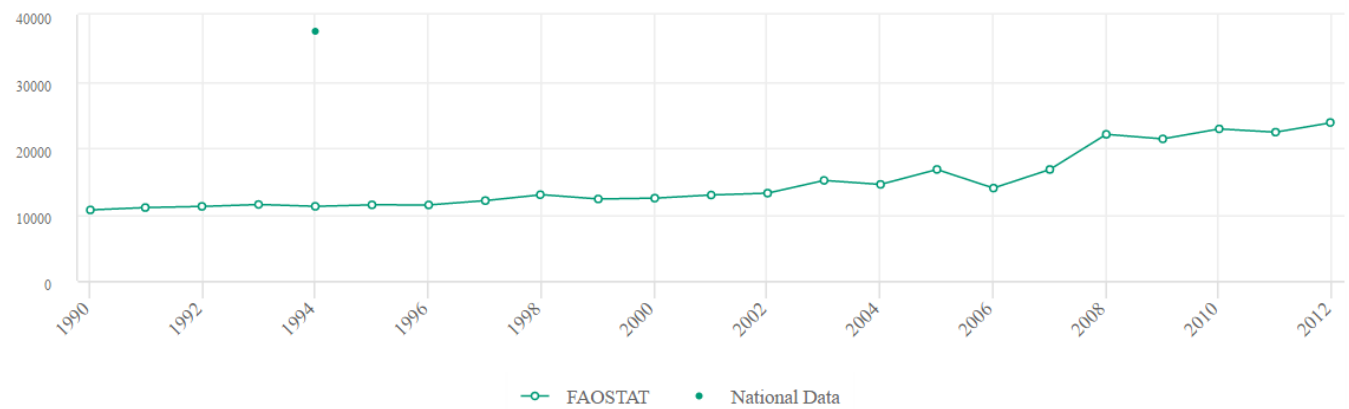
Sector: Agriculture

Agriculture Total | Enteric Fermentation | Manure Management | Rice Cultivation | Agricultural Soils | Burning - Savanna | Burning - Crop Residues

Charts | Tables

Item: Agriculture Total

Emissions (Gg CO_2eq)



New Data Analytical Tools based on FAOSTAT: QA/QC

Comparing National Data and FAOSTAT – e.g. from Uganda Manure Management

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Country: Uganda

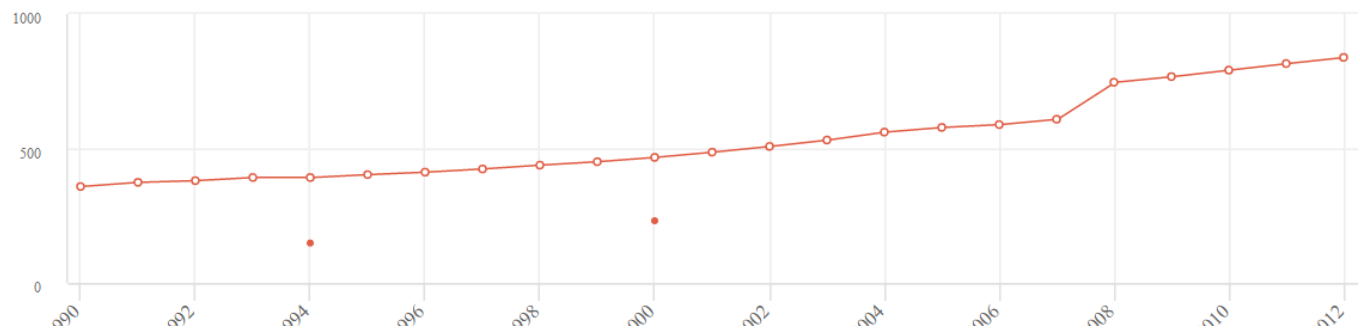
Sector: Agriculture

Agriculture Total | Enteric Fermentation | Manure Management | Rice Cultivation | Agricultural Soils | Burning - Savanna | Burning - Crop Residues

Charts | Tables

Item: Manure Management

Emissions (Gg CO_2eq) from CH_4



Intro to GHG Exercises (part II)

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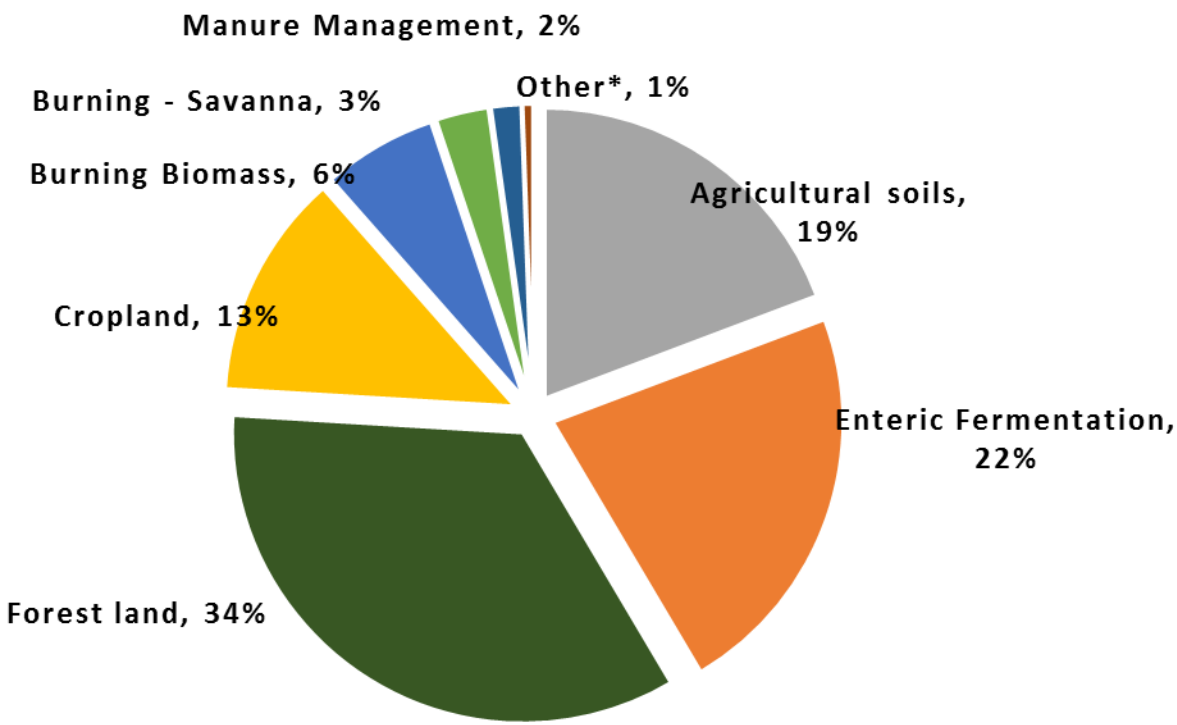
Key sources of emissions (Uganda 2nd Nat. Communication)

Table 2-13: Key Categories for Uganda in 2000

CATEGORIES	Current Year Emission **Estimate** (Gg CO_2eq)	Level assessment	Cumulative Percentage
3C5 - Indirect N2O Emissions from Managed Soils - indirect N2O	15,686	0.379	38%
3B1a - Forest Land Remaining Forest Land (Emissions) - CO2	6,373	0.154	53%
3A1 - Enteric Fermentation - CH4	4,830	0.117	65%
3B2b - Land Converted to Cropland (Emissions) - CO2	3,280	0.079	73%
1A4 - Fuel Combustion Activities - Other Sectors - CH4	3,045	0.074	80%
3 - Miscellaneous – Forests - CH4	1,302	0.031	83%
3B2b - Land Converted to Cropland (Removals) - CO2	-946	0.023	86%
1A3b - Fuel Combustion Activities - Transport - Road transportation - CO2	808	0.020	88%
4A - Solid Waste Disposal - CH4	630	0.015	89%
1A4 - Fuel Combustion Activities - Other Sectors - N2O	589	0.014	90%
5B - Other LULUCF Soils - CO2	513	0.012	92%
3C7 - Rice Cultivations - CH4	454	0.011	93%
3B2a - Cropland Remaining Cropland (Removals) - CO2	-429	0.010	94%
3 - Miscellaneous – Forests - N2O	372	0.009	95%

Key sources of emissions (AFOLU) from FAOSTAT database

FAOSTAT (year 2012) Approx. 49,000 Gg CO_2eq



* Other (< 1% of AFOLU emissions) (Burning Crop residues; Direct CO_2 emissions from organic soils on grassland; Burning of Crop Residues)

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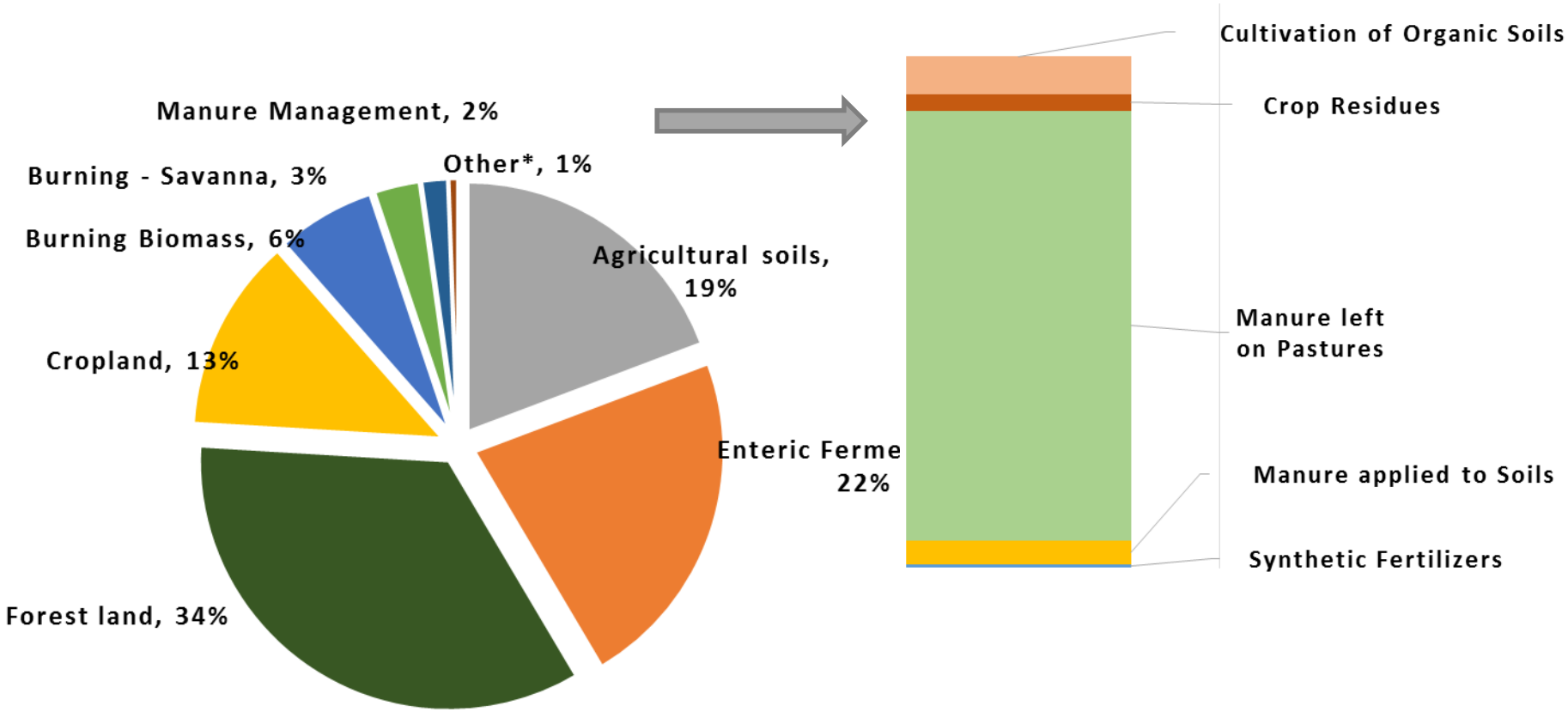

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THANK YOU

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