FAOSTAT Domain Emissions Totals. Methodological note, release October 2023

Dataset Information:

Title	**Emissions Totals**
Abstract	The FAOSTAT domain Emissions Totals summarizes the greenhouse gas (GHG) emissions disseminated in the FAOSTAT Climate Change domains of emissions from agrifood systems. Data are computed following the Tier 1 methods of the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National greenhouse gas (GHG) Inventories (IPCC, 1996; 1997; 2000; 2002; 2006; 2014). Emissions from other economic sectors as defined by the IPCC are also disseminated in the domain for completeness. The domain includes methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2) emissions from all the above activities as well as the aggregate fluorinated gases (F-gases) emissions used in industrial processes. Estimates are available by country, with global coverage for the period 1961–2021 with projections for 2030 and 2050 for some categories of emissions or 1990–2021 for others. The database is updated annually.
Supplemental	The FAOSTAT domain **Emissions Totals** disseminates information estimates of CH_4, N_2O, CO_2 emissions/removals, F-gases and their aggregates in CO_2eq in units of kilotonnes (kt, or 10^6 kg). The latter are computed by using the IPCC Fifth Assessment report global warming potentials, AR5 (IPCC, 2014). Data are available for most countries and territories, for standard FAOSTAT regional aggregations, and for Annex I and non-Annex I country groups. This domain jointly disseminates the emissions reported by countries to the United Nations Framework Convention on Climate Change (UNFCCC). Emission data are sourced directly from the UNFCCC data portal as submitted by countries through their most recent GHG National Inventories (NGHGI) or are extracted from Biennial Update Reports (BURs). UNFCCC data are disseminated in FAOSTAT with permission, formalized via a FAO-UNFCCC Memorandum of Understanding. The IPCC guidelines consider the FAOSTAT database as a useful tool for NGHGI QA/QC processes and validation of both activity data and emissions estimates (IPCC, 2019).
Creation Date	2012
Last Update	2023
Data Type	Climate Change - Greenhouse Gases
Category	Environment
Time Period	1961–2021; projections for 2030 and 2050; 1990–2021
Periodicity	Annual
Geographical Coverage	World
Spatial Unit	In 2021, 198 countries and 34 territories (FAO Tier I)
Language	Multilingual (EN, FR, ES)

Methodology and Quality Information:

Methods and processing

Overview

The FAOSTAT domain *Emissions Totals* includes estimates of GHG emissions from agri-food systems. These cover the emissions generated within **farm gate**, those associated with the **land use change** and the emissions from **pre- and post-production** food processes. Table 1 provides the categories covered.

Table 1. Categories of emissions from the agri-food systems

Category	Time series	CH_4	N_2O	CO_2	CO_2eq
Burning - crop residues	1961–2021; 2030; 2050	✓	✓		
Crop residues			✓		
Enteric fermentation		✓			
Manure applied to soils			✓		
Manure left on pasture			✓		
Manure management		✓	✓		
Rice cultivation		✓			
Savanna fires		✓	✓		
Synthetic fertilizers			✓		
Drained organic soils	1990–2021		✓	✓	
Fires in organic soils	1990–2021	✓		✓	
Forest fires	1990–2021	✓	✓		
Forestland	1990–2021			✓	
Net forest conversion	1990–2021			✓	
On-farm energy use	1990–2021	✓	✓	✓	
Fertilizers manufacturing	1990-2021	✓	✓	✓	
Pesticides manufacturing	1990–2021	✓	✓	✓	
Food processing	1990-2021	✓	✓	✓	
Food transport	1990-2021	✓	✓	✓	
Food retail	1990-2021	✓	✓	✓	
Food systems waste disposal	1990-2021	✓	✓	✓	
Food household consumption	1990-2021	✓	✓	✓	
Food packaging	1990-2021	✓	✓	✓	

Estimates for Pre- and Post- Production food processes

Emissions totals also disseminates the GHG estimates from pre- and post- production food processes. Emissions are calculated based on data from the UN Statistical Division (UNSD), the International Energy Agency (IEA) and other third-party as well as by integrating emission information from the PRIMAP-hist dataset v2.4 (Gütschow et al., 2022). Methodologies for these estimates are described in dedicated working papers as follows: I) food transport; II) food systems waste disposal and III) fertilizers and pesticides manufacturing, food processing, retail, packaging and household consumption.

To note that, the world aggregate estimates of food transport also includes international bunkers related to food. Emissions from "International Bunkers" is derived from data on 'International aviation' and 'International navigation/shipping' of the

EDGARv6.0 dataset (JRC/PBL, 2019), covering the period 1990–2018 and extrapolated linearly to 2021 by using the average growth rate of the 2016–2018 period. Emissions for this category only available for the world aggregate.

PRIMAP data for other IPCC sectors

For completeness and in view of computing shares of emissions for the whole economy (these are disseminated separately in the FAOSTAT domain Emissions indicators), Emissions totals also disseminates data from other IPCC economic sectors, namely energy, industrial processes and product use (IPPU), waste and other n.e.c. These data are sourced from the PRIMAP-hist v2.4 dataset (Gütschow et al., 2023).

Territorial definitions

The territorial definitions of the PRIMAP-hist dataset are based on the list of countries reporting their emissions under the UNFCCC (Gütschow et al., 2016). These definitions differ from the FAOSTAT list of countries and territories, which in turn reflects the annual reporting of member countries to FAO. For instance, PRIMAP emissions data for the United Kingdom include Bermuda as well as other countries/territories for which FAOSTAT disseminates instead the emissions estimates separately. In practice, in the final dataset, data for these countries and territories are not available for all sectors. The table in annex summarizes the differences in territorial definitions between PRIMAP-hist and FAOSTAT.

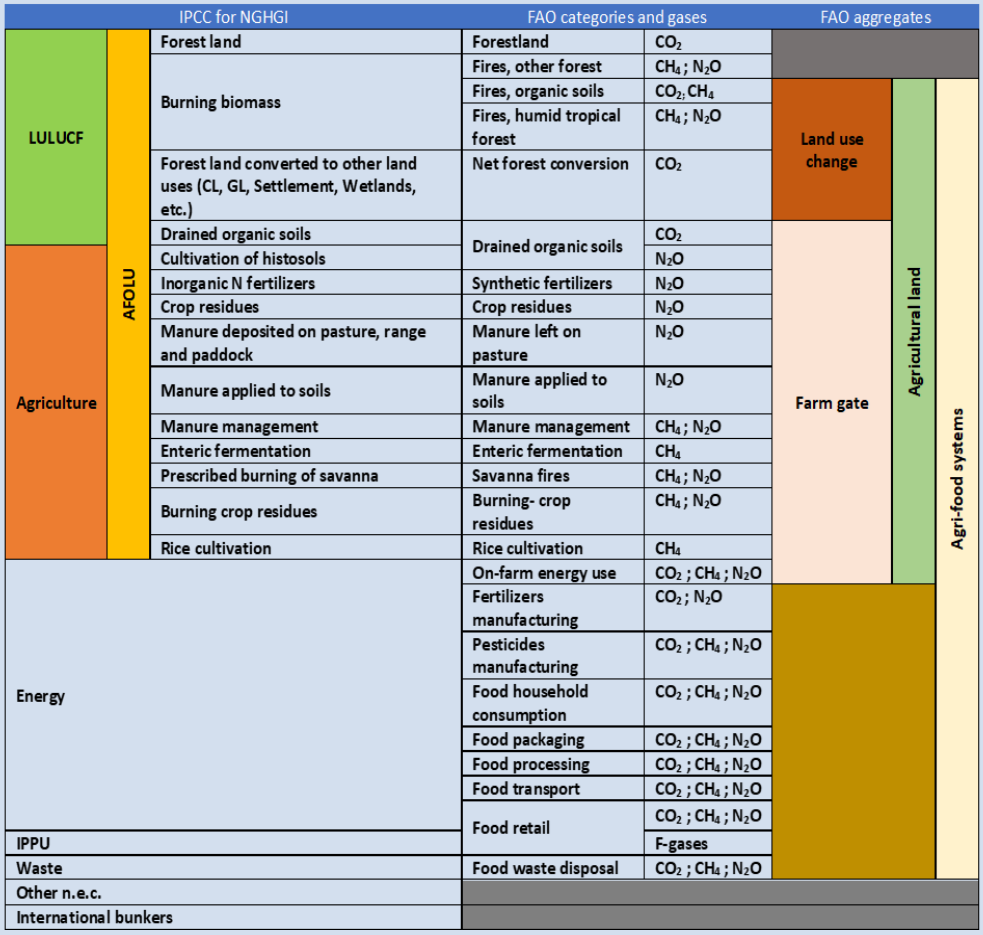
Preparation of the time series from PRIMAP data

In line with UNFCCC standards (Gütschow et al., 2016), PRIMAP data attributes the emissions originating from a certain territory at any point in time to the state the territory currently belongs to. Thus, for the entire time series (1850–2021), emissions are attributed to the country/territory now present, including back in time when it was part of a different country or territory. Conversely, FAOSTAT data follows the actual country and territory composition and its changes over time. For instance, FAOSTAT emissions estimates for the former Soviet Union (USSR) are available until 1991. From 1992 onward, statistics are disseminated for the 15 countries originated from the split. To maintain consistency along the entire time series, PRIMAP data are thus aggregated backward in time as appropriate following the same logic as in FAOSTAT data.

UNFCCC country reports

The domain Emissions Totals also disseminates data reported by countries to the UNFCCC in their national GHG inventories (NGHGI). Figure 1 summarizes the correspondence between UNFCCC and FAOSTAT categories. For additional guidance, a more detailed mapping is also provided as a separate document in this and in all the single FAOSTST domains of the Emissions database. It should be noted that due to incomplete reporting, significant data gaps characterize aggregated values for countries belonging to the non-Annex I group as defined by UNFCCC. Nonetheless, values for these countries and for the non-Annex I aggregate are disseminated to highlight the existing data gaps.

Figure 1. Correspondence between IPCC, FAO emissions categories and aggregates



Global Warming Potential (GWP)

Emissions in singles gases are converted into their CO_2 equivalents using the IPCC (2014) AR5 global warming potential coefficients corresponding to a 100-year horizon. Specifically, we used: GWP(CO_2)=1; GWP(CH_4)=28 GWP(N_2O)=265.

Table 2. Global Warming Potentials (GWPs) relative to CO_2 (dimensionless)

	Greenhouse gas	GWP AR4 (IPCC, 2007)	GWP AR5 (IPCC, 2014)
Single gases	N_2O	298	265
	CO_2	1	1
	CH_4	25	28
	HFC-23	14 800	12 400
	HFC-32	675	677
	HFC-41		116
	HFC-125	3 500	3 170
	HFC-134		1 120
	HFC-134a	1 430	1 300
	HFC-143		328
	HFC-143a	4 470	4 800
	HFC-152		16

F-gases	HFC-152a	124	138
	HFC-161		4
	HFC-227ea	3 220	3 350
	HFC-236cb		1 210
	HFC-236ea		1 330
	HFC-236fa	9 810	8 060
	HFC-245ca		716
	HFC-245fa	1 030	858
	HFC-365mfc	794	804
	HFC-43-10mee	1 640	1 650
	Sulfur hexafluoride (SF_6)	22 800	23 500
	Nitrogen trifluoride ($NF_{3)}$	17 200	16 100
	PFC-14	7 390	6 630
	PFC-116	12 200	11 100
	PFC-218	8 830	8 900
	PFC-318	10 300	9 540
	PFC-31-10	8 860	9 200
	PFC-41-12	9 160	8 550
	PFC-51-14	9 300	7 910
	PCF-91-18	7 500	7 190

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Data Collection Method	Computed
Completeness	100%
Useful links	http://www.fao.org/food-agriculture-statistics/statistical-domains/environment/en/ http://www.ipcc-nggip.iges.or.jp/public/ https://di.unfccc.int/detailed_data_by_party

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ANNEX*

MAIN TERRITORIAL DEFINITION		COUNTRIES / TERRITORIES / DEPENDENCIES		
		included	***with independent data***	***w/out independent data***
Australia	***PRIMAP***	*Norfolk Island; Christmas Island; Cocos Islands; Heard and Mc-Donald Islands*		
	FAOSTAT	Christmas Island; Cocos Islands	Norfolk Island	Heard and Mc-Donald Islands
China	***PRIMAP***		*Hong Kong; Macao; Taiwan*	
	FAOSTAT		China, Hong Kong SAR; China, Macao SAR, China, Taiwan Province of	
Denmark	***PRIMAP***	*Faroe Islands; Greenland*		
	FAOSTAT		Faroe Islands; Greenland	
Israel	***PRIMAP***	*Palestinian Territory*		
	FAOSTAT		Palestine	
Finland	***PRIMAP***	*Åland Islands*		
	FAOSTAT			
Morocco	***PRIMAP***	*Western Sahara*		
	FAOSTAT		Western Sahara	
Netherlands	***PRIMAP***		*Aruba; Netherlands Antilles (Bonaire; Curacau; Saba; Sint Eustatius; Sint Maaten)*	
	FAOSTAT		Aruba, Netherlands Antilles (former)	
Norway	***PRIMAP***	Svalbard		
	FAOSTAT	Bouvet Island		Svalbard and Jan Mayen Islands
New Zealand	***PRIMAP***			*Tokelau*
	FAOSTAT		Tokelau	
	PRIMAP	*Bermuda; Cayman Islands;*	*Anguilla; British Indian Ocean*	

		Channel Islands; Falkland Islands (Malvinas); Gibraltar; Guernsey; Isle Of Man; Jersey; Montserrat	*Territory; Pitcairn Islands; Saint Helena, Ascension and Tristan da Cunha; Turks and Caicos Islands; British Virgin Islands*	
United Kingdom	**FAOSTAT**		Bermuda; Cayman Islands; Channel Islands; Falkland Islands (Malvinas); Gibraltar; Isle Of Man; Montserrat; Anguilla; Pitcairn Islands; Saint Helena, Ascension and Tristan da Cunha; Turks and Caicos Islands; British Virgin Islands	British Indian Ocean Territory
United States	***PRIMAP***	*Guam; Northern Mariana Islands; Puerto Rico; American Samoa; United States Virgin Islands*		
	FAOSTAT		Guam; Northern Mariana Islands; Puerto Rico; American Samoa; United States Virgin Islands	