

Dataset Information:

Title	Fires
Abstract	The FAOSTAT domain Emissions from Fires consists of estimates of methane (CH ₄), nitrous oxide (N ₂ O) and carbon dioxide (CO ₂) emissions generated from biomass burning in a range of vegetation types and the from fires in organic soils. Data are computed geospatially using Tier 1 default factors of the 2006 IPCC Guidelines for National greenhouse gas (GHG) Inventories and of the Supplement on Wetlands (IPCC, 2006; 2014) for the organic soils component. Estimates are available by country and with global coverage, in complete time series for the period 1990 – 2022. The database is updated annually.
Supplemental	<p>The FAOSTAT domain <i>Fires</i> disseminates information by country on: activity data (in hectares of burned area and tonnes of burned biomass); and GHG emissions in kilotonnes of N₂O, CH₄ and CO₂. Data are available for all countries and territories, for standard FAOSTAT regional aggregations, and for Annex I and non-Annex I country groups.</p> <p>There are large uncertainties in the estimates of GHG emissions from fires in organic soils. Both literature and country data submitted to the UN Framework Convention on Climate Change (UNFCCC) however support and confirm the FAOSTAT estimates for South East Asian countries. Hence, due to the current lack of evidence for other regions of the world, we set to 0 all the country values outside Southeastern Asia (read more below in “Methods and processing”).</p> <p>This FAOSTAT domain also disseminates the activity data and GHG emissions reported by countries to the United Nations Framework Convention on Climate Change (UNFCCC) on fire disturbances for a range of vegetation types in Forest Land and Grassland and from fires in organic soils. Activity data are sourced from the most recently available GHG National Inventories (NGHGI) or from National Communications. Emission data are sourced directly from the UNFCCC data portal or from Biennial Update Reports (BURs). UNFCCC data are disseminated in FAOSTAT with permission, formalized via a FAO-UNFCCC Memorandum of Understanding.</p> <p>The IPCC recommends the use of the FAOSTAT database to countries as a tool for NGHGI QA/QC processes and validation of both activity data and emissions estimates (IPCC, 2019).</p>
Creation Date	2012
Last Update	2023
Data Type	Climate Change - Greenhouse Gases
Category	Agriculture - Environment
Time Period	1990–2022
Periodicity	Annual
Geographical Coverage	World
Spatial Unit	In 2022, 197 countries and 36 territories (FAO TIER I)
Language	Multilingual (EN, FR, ES)

Methodology and Quality Information:

Methods and processing	<p>Overview</p> <p>All geospatial data in this domain are accessed and processed within the geospatial cloud platform Google Earth Engine (GEE) and statistics were aggregated at country level, using the FAO Global Administrative Unit Layers (GAUL) dataset (last available version 2015).</p> <p>The estimates of activity data and emissions from fire disturbances in a range of vegetation types and in organic soils are made at pixel level, applying the general formula:</p>
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$$GHG = A * EF$$

where:

GHG = Annual emissions, in g CH₄, g N₂O and g CO₂ as appropriate by land use/cover type;

A = Activity data, representing the total burned biomass, in kg of dry matter;

EF = Tier 1, default IPCC emission factors, expressed in g CH₄, g N₂O or g CO₂, per kg of dry matter that is burnt.

The annual burned area for each Item disseminated (“Forest fires”; “Savanna fires”; and “Fires in organic soils”) is derived from the new NASA Moderate Resolution Imaging Spectroradiometer (MODIS) MCD64A1 Collection 6.1 (Giglio et al., 2022). The MCD64A1 Version 6.1 Burned Area is a monthly, global gridded 500m product containing per-pixel burned-area and quality information. Fire data are encoded in a single data layer as the ordinal day of the calendar year on which the burn occurred, with values assigned to unburned land pixels and additional special values reserved for missing data and water grid cells. Only those pixels with percentage uncertainty lower than 20 percent are selected for this methodology.

The types of vegetation are identified from the MODIS Land Cover product (MCD12Q1 version 6.1) (Sulla-Menashe and Friedl, 2022). The land cover categories are specifically those of the Land Cover type 1, which applies the 17-class legend of the International Geosphere-Biosphere Programme classification (IGBP; Loveland and Belward, 1997). The item Fires in organic Soils disseminated in this FAOSTAT domain is not properly a land cover type. Data for this item are obtained by overlaying the information on fires with the Histosols class of the Harmonized World Soil Database (FAO et al., 2012). Fires in organic soils are detected independently from the land cover type under which they occur (the built-up areas, barren and inland water pixels were excluded *a priori* from the analysis).

The total burned biomass is computed by multiplying the burned area in each pixel by the fuel biomass consumption values, using the appropriate coefficients by vegetation type or for the organic soils.

Input data on fires are available from 2001 to 2022. Values backward are filled as follows:

- 1996–2000 are filled with earlier FAOSTAT estimates (Rossi et al., 2016);
- 1990–1995 are filled with averaged values of the reconstructed time series (1996–2022).

Earlier versions of this methodology were described in Rossi et al. (2016) and Proserpi et al. (2020).

Uncertainties in estimates of GHG emissions are due to uncertainties in emission factors and activity data. They may be related to, inter alia, natural variability, partitioning fractions, lack of spatial or temporal coverage, spatial aggregation, errors in satellite data. In the case of Biomass burning more detailed information is available in the IPCC guidelines (IPCC, 2006: Vol.4, Ch. 5, Section 5.2.4.4).

Forest fires — GHG emissions from burning of biomass in Forest land includes fires in ‘Humid Tropical Forest’ and ‘Other Forest’. They are computed at Tier 1 following IPCC, 2006, Vol. 4, Ch. 2, Eq. 2.27. The estimates from Forest fires exclude CO₂, since these are already covered in the carbon stock changes calculations carried out in the FAOSTAT [Forests](#) domain. The procedure to compute these emissions is as follows:

- 1) The overall category “Forest” is derived aggregating the pixels in the yearly land cover maps with in the following IGBP land cover categories: Evergreen

Needleleaf, Evergreen Broadleaf, Deciduous Needle-leaf, Deciduous Broadleaf, and Mixed Forests;

- 2) The item "Humid Tropical Forest," is obtained by overlaying the pixels classified as Forest with the relevant FAO-FRA Global Ecological Zones (FAO, 2012);
- 3) The item "Other Forest," is obtained subtracting the pixels previously classified as "Humid Tropical Forest" from all Forest pixels.

Fuel biomass consumption values for "Humid Tropical forest" and "Other forest" categories are taken from IPCC, 2006: Vol.4, Ch. 2, Tab. 2.4. Values are climate dependent, and were geographically allocated using the FAO-FRA Global Ecological Zones (FAO, 2012). Activity data and emissions are then estimated for the pixels in these land cover/climatic stratifications.

Savanna fires — GHG emissions from burning of biomass in Grassland includes fires in the following vegetation types: "Grassland"; "Savanna"; "Woody Savanna"; "Open shrubland"; and "Closed Shrubland". Estimates are computed at Tier 1 following IPCC, 2006, Vol. 4, Ch. 2, Eq. 2.27. The corresponding land cover types are identified from the MODIS Land Cover product (MCD12Q1 version 6.1) (Sulla-Menashe and Friedl, 2022).

Fuel biomass consumption values are taken from IPCC, 2006: Vol.4, Ch. 2, Tab. 2.4. The values by vegetation type are climate-dependent and were geographically allocated using the Climate Zones layer, developed by the Joint Research Centre of the European Commissions (JRC 2010) and based on IPCC Climatic Zones (IPCC, 2006). Default EF values by gas are taken from IPCC, 2006: Vol. 4, Ch. 2, Tab. 2.5.

Following the IPCC Guidelines (2006), only the non-CO₂ emissions (N₂O and CH₄) are disseminated for the vegetation types in Savanna fires with the assumption that the CO₂ emissions would be counterbalanced by CO₂ removals from the subsequent re-growth of the vegetation within one year.

Fires in organic soils — GHG emissions from burning of organic soils are computed at Tier 1, taking biomass consumption values and the EF values for peat fires (fires in organic soils) from the IPCC Wetlands Supplement (IPCC 2014), Ch.2, Tab 2.6 and Tab 2.7. Values are climate-dependent and were geographically allocated using the IPCC Climatic Zones layer (IPCC, 2006). CO₂ and CH₄ emissions are estimated and disseminated for this item based on the Supplement on Wetlands (IPCC, 2014).

The uncertainties in FAOSTAT estimates of the emissions from fires in organic soils are very high (IPCC, 2014). FAOSTAT estimates rely on remotely sensed data of burning biomass in areas where organic soils are also mapped. On the one hand, the presence of fires may not always be a signal that the underlying peat layer is burning. On the other, remote sensing information has limited capacity to detect the smoldering fires that are typical of peatlands. Furthermore, the methods applied herein do not distinguish between fires on drained and undrained organic soils, rather assuming burning of the organic layer in both cases. Existing literature and country reports support FAOSTAT country estimates in South East Asia (e.g. Indonesia, Malaysia and Brunei Darussalam), where burning of the organic layer is associated with deforestation fires and drainage. In all other countries, absence of literature and lack of other evidence suggest that FAOSTAT emissions data from fires in organic soils should be used with caution, as a tool to investigate possible national hotspots, rather than for evaluating national GHG inventory data. There is insufficient information to date to confirm the actual presence, quantity and causes (i.e. human-induced vs wildfires) of fires in organic soils outside Southeastern Asia.

For these reasons, the burnt areas and the emissions from fires in organic soils under this domain are set to 0 for all the countries that are not included in the FAOSTAT regional aggregate of South East Asia. For transparency and as a reference, an additional table

'AllFires_OrganicSoils.csv' is however available under the 'Related documents' section of the domain, which contains the complete set of data.

References

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Data Collection Method	100% Computed from underlying geospatial information and aggregated at national level
Completeness	100%
Useful links	http://www.ipcc-nggip.iges.or.jp/public/ https://unfccc.int https://earthengine.google.com/ http://www.fao.org/economic/ess/environment/en/

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Citation	FAO, 2023. FAOSTAT Climate Change: Agrifood systems emissions, Emissions from Fires http://www.fao.org/faostat/en/#data/GI
Acknowledgements	The FAOSTAT Emissions database is developed and maintained by FAO Statistics Division (ESS). Initial support was kindly provided by Norway and Germany under Trust Funds GCP/GLO/286/GER and GCP/GLO/325/NOR. This update of the fire emissions estimates was prepared in collaboration with the Land Monitoring team of the FAO Climate Change, Biodiversity and Environment Office. Support by UNFCCC in information sharing and facilitation of data access is also graciously acknowledged.

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