

Dataset Information:

Title	Organic soils
Abstract	The FAOSTAT Emissions from drained organic soils domain consists of nitrous oxide (N ₂ O) and carbon dioxide (CO ₂) emissions generated from the mineralization and oxidation of organic matter in organic soils that are drained for agricultural activities. Data are computed geospatially, using the Tier 1 method of the 2006 IPCC Guidelines for National greenhouse gas Inventories (IPCC, 2006) and using the distribution of <i>histosols</i> as a proxy for organic soils and yearly land cover maps for the spatial distribution of cropland and grassland organic soils. Estimates are available by country and with global coverage, in complete time series for the period 1990–2024. The database is updated annually.
Supplemental	The FAOSTAT domain <i>Emissions from drained organic soils</i> disseminates information by country on: activity data (in hectares of organic soils drained for agriculture); and greenhouse gas (GHG) emissions (in kilotonnes of N₂O and CO₂). Drainage and associated emissions are assessed separately for IPCC land use categories “Cropland” and “Grassland”, corresponding to FAO land use categories “Cropland” and “Permanent meadows and pastures.” Data are available for all countries and territories, for standard FAOSTAT regional aggregations, and for Annex I and non-Annex I country groups. This FAOSTAT domain also disseminates the activity data and emissions data reported by countries to the United Nations Framework Convention on Climate Change (UNFCCC), under ‘Cultivation of organic soils’ for the N₂O component and categories ‘Cropland drained organic soils’ and ‘Grassland drained organic soils’ for the CO₂. 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. 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).
Creation Date	2012
Last Update	2025
Data Type	Climate Change - Greenhouse Gases
Category	Agriculture; Environment
Time Period	1990–2024
Periodicity	Annual
Geographical Coverage	World
Spatial Unit	Country aggregations from geospatial processing. In 2023, 197 countries and 33 territories (FAO Tier I)
Language	Multilingual (EN, FR, ES)

Methodology and Quality Information:

Methods and processing	Overview Greenhouse Gas (GHG) Emissions from <i>Drained Organic Soils</i> consist of the N₂O and CO₂ losses to the atmosphere due to the oxidation of the organic matter when organic soils are drained for agricultural activities. Estimates are computed separately for IPCC land use categories “Cropland” and “Grassland,” at Tier 1 following IPCC, 2006, Vol. 4, Ch. 11. They correspond to estimates of the extent of drained organic soils under FAO land use categories “Cropland” and “Permanent meadows and pastures,” respectively. Activity data and emissions are computed at a pixel level, by applying the general formula:
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$$GHG = A * EF$$

where:

GHG = Annual emissions, in units of kg N₂O–N yr⁻¹ or tonnes CO₂–C ha⁻¹

A = Activity data, corresponding to the annual area of drained organic soils, in hectares.

EF = Tier 1, default IPCC emission factors, expressed in units of kg N₂O–N ha⁻¹ and in tonnes CO₂–C ha⁻¹.

Uncertainties in estimates of GHG emissions are due to uncertainties in emission factors, activity data, as well as in the underlying land cover maps used. More detailed information is available in the IPCC guidelines (IPCC, 2006: Vol. 4, Ch. 5, Section 5.2.3.5). Relevant discussions on methods and uncertainties are available in Tubiello et al. (2016).

Data sources

Activity data are obtained from geoprocessing and stratification of the following spatial datasets:

i. A map derived from the Harmonized World Soil Database (HWSD-FAO *et al.*, 2012) with percentages of the pixel area covered with *histosols* (both as dominant and secondary soil type). The area covered by *histosols* is used as a proxy for organic soils (IPCC 2006). Methods relevant to the development and use of this spatial layer are discussed in Conchedda and Tubiello (2020).

ii. Annual land cover maps produced by the Catholic University of Louvain Geomatics as part of the Climate Change Initiative of the European Spatial Agency (UCL Geomatics, 2017) and updated to version 2.1 under the European Copernicus program (2019). Cropland Land Use area is identified from available CCI-LC yearly land cover maps (1992–2020), by applying specific proportions to pixel area in the relevant land cover categories. Based on indications from the University of Louvain, this update applies revised cropland and grassland shares by pixel (Tab. 1 and Tab. 2).

This approach is consistent with the methods applied within the [FAOSTAT Land Cover](#) statistics.

Table 1. Percentage shares applied to compute the area of Cropland from the CCI-LC classes

CLASS CODE	LABEL	CROPLAND SHARE BY PIXEL
10	Cropland, rainfed	95%
11	<i>Cropland, rainfed, herbaceous cover*</i>	
12	<i>Cropland, rainfed, tree or shrub cover*</i>	
20	Cropland, irrigated or post-flooding	75%
30	Mosaic cropland (>50%) / natural vegetation (tree, shrub, herbaceous cover) (<50%)	
40	Mosaic natural vegetation (tree, shrub, herbaceous cover) (>50%) / cropland (< 50%)	25%

*Level 2 detail of the original CCI-LC legend / where available, regional information.

Likewise, the area of “Land used for permanent meadows and pastures”, corresponding to the IPCC “Grassland” land use category, is estimated from the corresponding land cover classes “grassland” and “shrubland,” obtained from CCI-LC. These are then superimposed with geospatial information on the livestock distribution, to estimate areas with the presence of grazing animals (see below). Land cover data from the CCI-LC maps are obtained by applying specific proportions to pixel area in the relevant land cover categories (Tab. 2).

Table 2. Percentage shares applied to compute the area of Grassland from the CCI-LC classes

CLASS CODE	LABEL	GRASSLAND SHARE BY PER PIXEL
130	Grassland	100%
140	Lichens and mosses	
150	Sparse vegetation	
120	Shrubland	
121	<i>Evergreen shrubland*</i>	
122	<i>Deciduous shrubland*</i>	
30	Mosaic cropland (>50%) / natural vegetation (tree, shrub, herbaceous cover) (<50%)	10%
40	Mosaic natural vegetation (tree, shrub, herbaceous cover) (>50%) / cropland (< 50%)	25%
100	Mosaic tree and shrub (>50%) / herbaceous cover (<50%)	25%
110	Mosaic herbaceous cover (<50%) / tree and shrub (>50%)	75%
10	Cropland rainfed	5%
11	<i>Herbaceous crops*</i>	
20	Cropland, irrigated or post-flooding	

*Level 2 detail of the original CCI-LC legend / where available, regional information.

iii. The presence of grazing animals is derived from the spatial distribution of cattle, sheep and goats as mapped in the Gridded Livestock of the World (Robinson et al, 2014). Animal numbers by pixel were first converted to Livestock Units (LU) using the same coefficients as in the domain [Livestock Patterns](#) of the FAOSTAT agri-environmental indicators. Pixels with LU values equal or higher than 0.1 LU (Critchley et al., 2008; Worrall and Clay, 2012) are superimposed to the layer of grassland organic soils to identify grazed grasslands on organic soils.

Estimates of the areas of drained organic soils were thus obtained as the area of non-zero overlap between the maps defined in *i*, *ii*, and *iii* above. For instance, in the case of cropland, the estimates are computed from the area of overlap of *histosols* and cropland, with the underlying assumption that organic soils must be drained to allow for crop cultivation activities. In the case of grassland, it is assumed that the trampling of grazing animals on organic soils covered with grasslands is associated with soil drainage and thus N₂O release.

Land cover information is sourced from yearly maps for the period 1992–2022. Values backward to 1990 are carried backward by using the 1992 values. The 2023 and 2024 values are a carry forward of the year 2022, pending the release of more recent CCI land cover maps.

Emission factors (EF)

The EF values for N₂O and CO₂ emissions are those specified in Chapter 2 of the IPCC Wetlands Supplement for drained inland organic soils (IPCC 2014) (Tab. 3 and Tab. 4). EF values are climate-dependent, and were allocated at pixel level to the relevant climatic

zones, as defined in IPCC, 2006: Vol. 4, Ch. 3, Annex 3A.5. The map of climate zones used in this analysis was developed by the Joint Research Centre of the European Commission (JRC, 2010), following IPCC (2006).

Table 3. IPCC emission factors (EF) for direct N₂O emissions from cropland and grassland drained organic soils*

CLIMATE TEMPERATURE REGIME	Default value (kg N ₂ O-N ha ⁻¹)*	
	Cropland	Grassland
Boreal / Cool Temperate	13	9.5
Warm Temperate		4.3
Tropical/Sub-Tropical	5	

*Source: Table 2.5, Ch. 2, 2013 IPCC Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventory: Wetlands.

Table 4. IPCC emission Factors (EF) for CO₂ emissions from drained organic soils*

CLIMATE TEMPERATURE REGIME	Default value (tonnes CO ₂ -C ha ⁻¹ yr ⁻¹)**	
	Cropland	Grassland
Boreal/ Cool Temperate	7.9	5.7
Warm Temperate		5.3
Tropical/Sub-Tropical	14	9.6

* Source: Table 2.1, Ch. 2, 2013 IPCC Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventory: Wetlands. ** C values are converted to CO₂ multiplying C values by the ratio of the molecular weight of carbon dioxide to that of carbon (44/12).

The analysis is carried out on the cloud processing platform of Google Earth Engine (GEE), combining the above datasets. GHG estimates made at a pixel level were subsequently aggregated at the country level, using the United Nations Geodata dataset (reference year 2023). The resulting spatial data are available in the [FAO Geospatial data platform](#) and in the [Google Earth Engine data catalog](#).

Supplementary documentation

The section Related Documents of this domain also contains a csv table with the total area of histosols by country, FAOSTAT regions and special groups. We mapped histosols in 107 countries and territories. This geospatial analysis indicated that Mozambique and Saint Pierre and Miquelon were the only two areas where histosols have never been drained for agriculture.

References

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Data Collection Method	100% Computed from underlying geospatial information and aggregated at the national level
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Completeness	100%
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Useful links	http://www.fao.org/food-agriculture-statistics/statistical-domains/environment/en/ http://www.ipcc-nggip.iges.or.jp/public/ https://unfccc.int http://maps.elie.ucl.ac.be/CCI/viewer/ https://www.esa-landcover-cci.org/?q=node/197
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Distribution Information:	
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