Estimating emissions from Biomass Burning

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Outline

- The FAOSTAT Emissions Database
- IPCC Guidelines
- Crop residues burning
- Vegetation burning:
  - Mapping Burned areas
  - Estimating Biomass burned
  - Estimating emissions
- Organic Soils burning

The FAOSTAT Emissions Database

Food and Agriculture Organization of the United Nations
FAOSTAT

& geo-referenced data

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IPCC 2006 Guidelines

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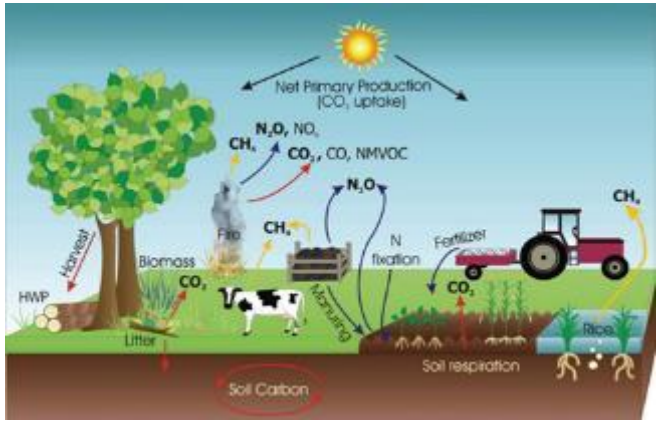


Emissions from Agriculture, Forestry, and Other Land Use (AFOLU): the FAOSTAT Emissions Database

DOMAIN	CATEGORY		GAS reported
Agriculture	Enteric Fermentation		CH_4
	Manure Management		CH_4, N_2O
	Rice Cultivation		CH_4
	Agricultural soils	Synthetic Fertilizers	N_2O
		Manure applied to soils	N_2O
		Manure left on pasture	N_2O
		Crop residues	N_2O
		Cultivated organic soils	N_2O
	Burning – Savanna		CH_4, N_2O
	Burning – Crop residues		CH_4, N_2O

DOMAIN	CATEGORY	GAS reported
LULUCF	Forest land	CO_2
	Cropland	CO_2
	Grassland	CO_2
	Burning Biomass	CH_4, N_2O, CO_2
	Wetlands	CO_2
	Settlements	CO_2
	Other land	CO_2

IPCC and UNFCCC methodology documents

- **Revised 1996 IPCC Guidelines** for National Greenhouse Gas Inventories (3 Volumes)
- **Good Practice Guidance** and Uncertainty Management in National greenhouse Gas Inventories (2000)
- **Database on GHG Emission Factors** (EFDB) (2002)
- **Good Practice Guidance** for Land Use, Land-Use Change and Forestry (2003)
- **UNFCCC Handbooks** for Non-Annex I countries
- **2006 IPCC Guidelines** for National Greenhouse Gas Inventories (5 volumes)
- **IPCC Software**

Estimation of GHG emissions

(IPCC Guidelines for National Greenhouse Gas Inventories)

Emissions = Activity Data * Emission Factor

Activity data:

- information on the extent to which a human activity resulting in emissions or removals of GHG takes place during a given period of time
- typically derived from statistics, but also from other sources;
- availability and quality are the primary driving factors determining the accuracy and reliability of the GHG emissions inventory.

Emission factor:

- emissions or removals of a given GHG per activity unit

Estimation of GHG emissions from biomass burning

$$E = \underbrace{A \bullet M_B \bullet C_f}_{\text{Activity data}} \bullet EF$$

Activity data *= Dry matter burned*

E = GHG emissions from fire (N_2O, CH_4).

A = Area burned

M_B = Mass of fuel available for combustion (biomass, ground litter, and dead wood)

Cf = Combustion factor (proportion of fuel actually combusted; depends on the size and architecture of fuel, e.g. leaves, tree stems)

EF = Emission Factors for different gases (N_2O, CH_4).(g /kg dry matter burnt)

Estimation of GHG emissions from burning of crop residues (wheat, maize, rice and sugarcane)

$$E = \underbrace{A \bullet M_B \bullet C_f}_{\text{Activity data}} \bullet EF$$

Activity data = *Dry matter burned*

E = GHG emissions from fire (N_2O, CH_4).

A = Area burned obtained as a fixed 10% of the harvested area from FAOSTAT).

M_B
Cf
EF

IPCC default values (Tier 1 default values for Biomass consumption: tables 2.4/2.5 of the IPCC 2006 Guidelines, V.4, Ch.2).

Estimation of GHG emissions from burning of vegetation

$$E = \underbrace{A \bullet M_B \bullet C_f}_{\text{Activity data}} \bullet EF$$

Activity data = *Dry matter burned*

E = GHG emissions from fire (N_2O, CH_4).

A = Area burned obtained from the Global Fire Emission Database (GFED4) - Burned Areas dataset (based on MODIS and SPOT-VEGETATION, 13 LC classes)

M_B

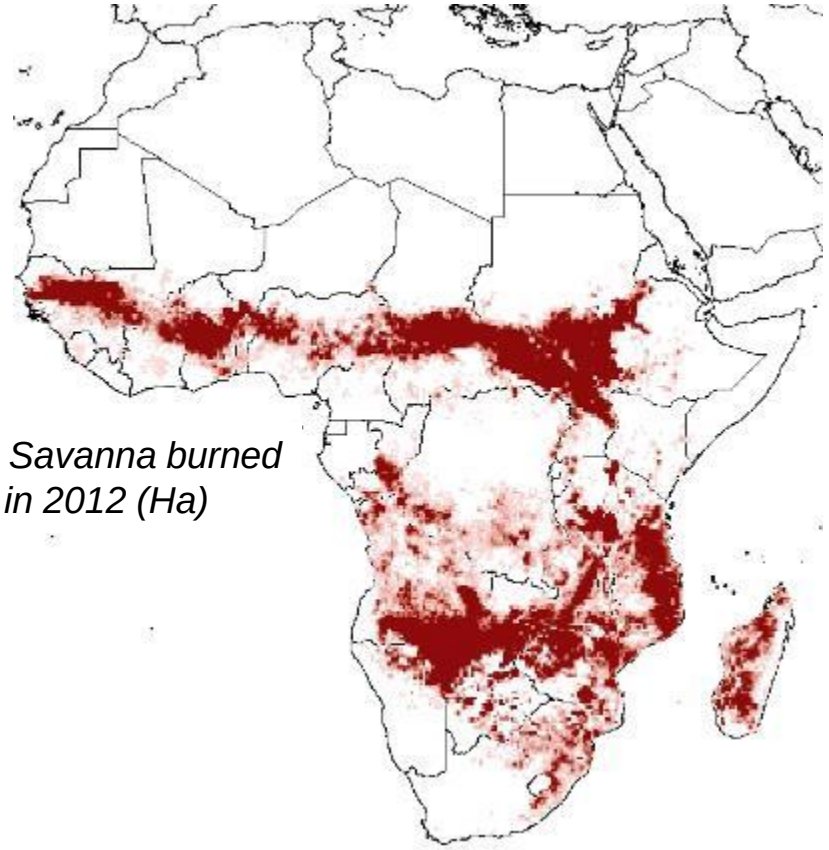
Cf

EF

IPCC default values (Tier 1 default values for Biomass consumption: tables 2.4/2.5 of the IPCC 2006 Guidelines, V.4, Ch.2).

Estimation of GHG emissions from burning of vegetation: *1 - Mapping area burned*

UMD Classification
Water
Evergreen Needleleaf forest
Evergreen Broadleaf forest
Deciduous Needleleaf forest
Deciduous Broadleaf forest
Mixed forest
Closed shrublands
Open shrublands
Woody savannas
Savannas
Grasslands
Croplands
Urban and built-up
Barren or sparsely vegetated
Unclassified

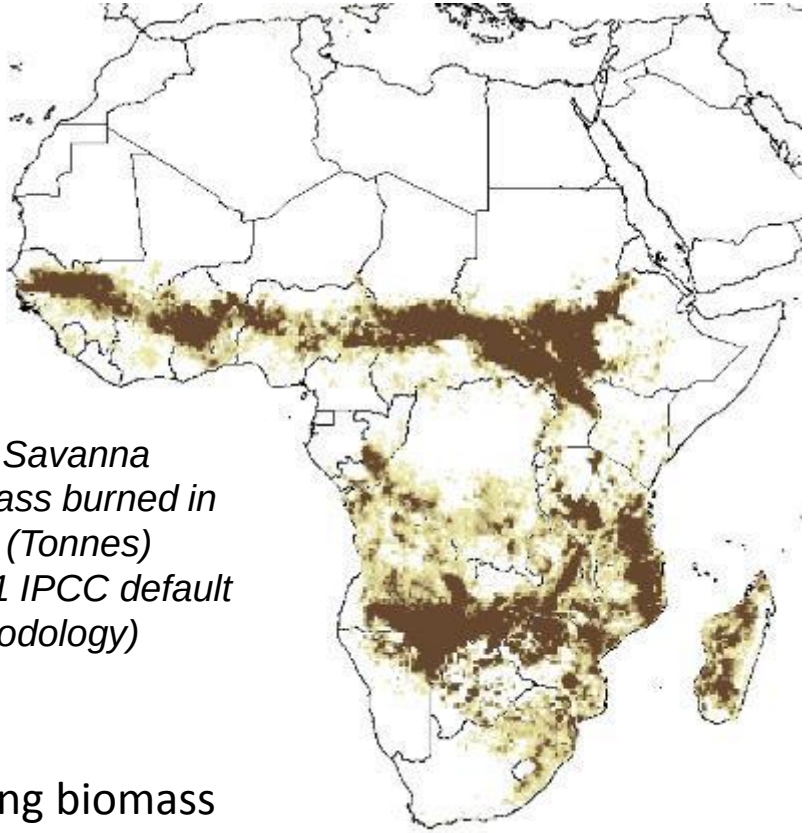


Total Savanna burned area in 2012 (Ha)

Estimation of GHG emissions from burning of vegetation: *2 - Estimating biomass burned*

Example: Savanna	
IPCC classification	**Biomass burned/ha (IPCC default values)**
Savanna - Tropical	7
Savanna - Non Tropical	4.1

Climate zones are identified using the JRC Climate Map based on the IPCC Climatic Zones layer.



Total Savanna biomass burned in 2012 (Tonnes) (Tier1 IPCC default methodology)

Biomass burned is estimated at pixel level by multiplying biomass burned per Ha by the area burned

Estimation of GHG emissions from burning of vegetation: *3 - Emission factors*

TABLE 2.5
EMISSION FACTORS (g kg^{-1} DRY MATTER BURNT) FOR VARIOUS TYPES OF BURNING. VALUES ARE MEANS ± SD AND ARE BASED ON THE COMPREHENSIVE REVIEW BY ANDREAE AND MERLET (2001)
(To be used as quantity 'G_{ef}' in Equation 2.27)

Category	CO_2	CO	CH_4	N_2O	NO_X
Savanna and grassland	1613 ± 95	65 ± 20	2.3 ± 0.9	0.21 ± 0.10	3.9 ± 2.4
Agricultural residues	1515 ± 177	92 ± 84	2.7	0.07	2.5 ± 1.0
Tropical forest	1580 ± 90	104 ± 20	6.8 ± 2.0	0.20	1.6 ± 0.7
Extra tropical forest	1569 ± 131	107 ± 37	4.7 ± 1.9	0.26 ±0.07	3.0 ± 1.4
Biofuel burning	1550 ± 95	78 ± 31	6.1 ± 2.2	0.06	1.1 ± 0.6

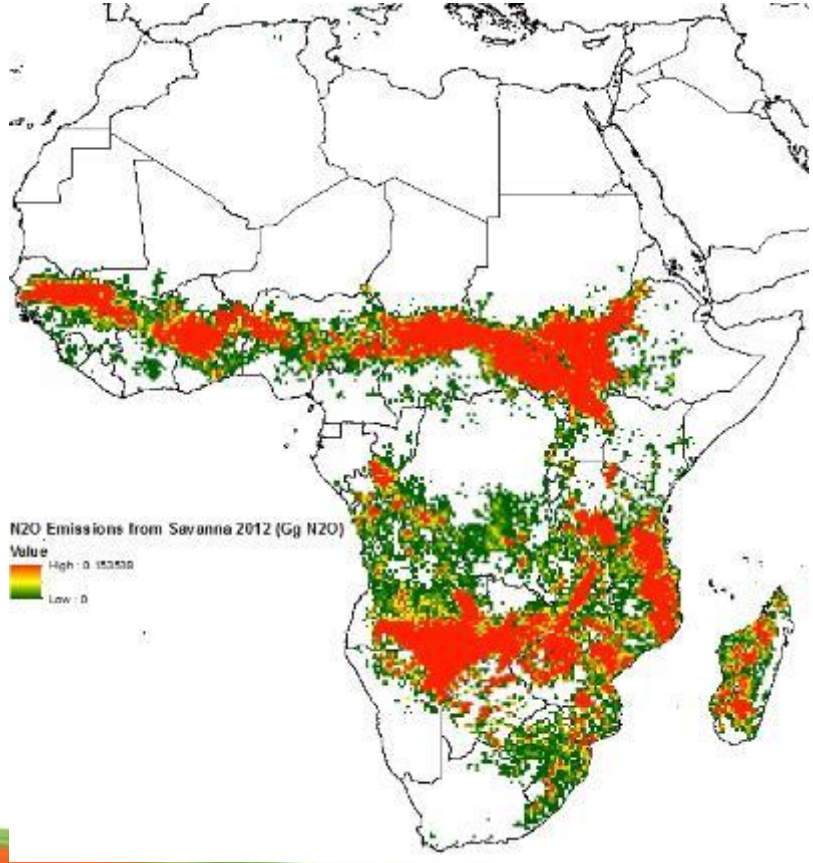
Note: The "extra tropical forest' category includes all other forest types.

Note: For combustion of non-woody biomass in Grassland and Cropland, CO_2 emissions do not need to be estimated and reported, because it is assumed that annual CO_2 removals (through growth) and emissions (whether by decay or fire) by biomass are in balance (see earlier discussion on synchrony in Section 2.4.

Default emission factors are provided by the IPCC Guidelines and assigned to each pixel according to the vegetation type and to the climatic zone (JRC-IPCC Climatic Zones).

Estimation of GHG emissions from burning of vegetation: *4 - Emissions*

Emissions = Activity Data * Emission Factor



Estimation of GHG emissions from burning of organic soils

$$E = \underbrace{A \bullet M_B \bullet C_f}_{\text{Activity data}} \bullet EF$$

Activity data *= Dry matter burned*

E = GHG emissions from fire (N_2O, CH_4).

A = Area burned obtained using the total burned area from GFED4 and the organic soils percentage per pixel obtained from the Harmonized World Soil Database (HWSD).

M_B
Cf
EF

IPCC default values (Tier 1 default values for Biomass consumption: tables 2.4/2.5 of the IPCC 2006 Guidelines).

Browse Data

BY DOMAIN | BY COUNTRY / REGION | RANKINGS

FAOSTAT Domains

- Food Security
- Investment
- SOFI Undernourishment
- Production
- Trade
- Food Supply
- Commodity Balances
- Food Balance Sheets
- Prices
- Resources
- Population
- Agri-Environmental Indicators
- Emissions - Agriculture
  - Enteric Fermentation
  - Manure Management
  - Rice Cultivation
  - Synthetic Fertilizers
  - Manure applied to Soils
  - Manure left on Pasture
  - Crop Residues
  - Cultivation of Organic Soils

Burning - Savanna

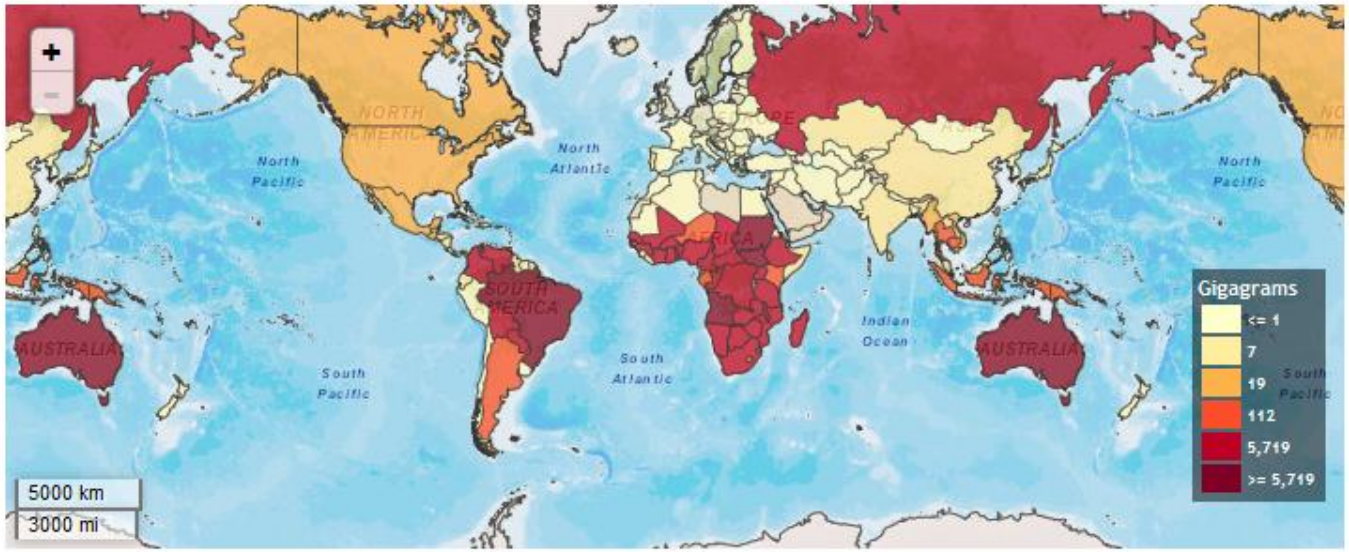
1961-Present | Projections

Emissions of methane and nitrous oxide from biomass combustion in savanna, woody savanna, open and closed shrublands, and grasslands.

ITEM	AREA	FROM YEAR	TO YEAR	AGGREGATION
Savanna	World	1990	2012	Average

Emissions by country (CO2 equivalent)

Average 1990 - 2012



The designations employed and the presentation of material in the maps do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal or constitutional status of any country, territory or sea area, or concerning the delimitation of frontiers.
South Sudan declared its independence on July 9, 2011. Due to data availability, the assessment presented in the map for Sudan and South Sudan reflects the situation up to 2011 for the former Sudan.

Thank you!

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http://faostat.fao.org/
http://www.fao.org/climatechange/micca/ghg/en/

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