

Small scale agricultural burning in Italy

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Open and stubble burning of agricultural residues

The EMEP/EEA methodology already provided for the two separate emission categories as they relate to two distinct processes:

SNAP 0907 Open burning of agricultural wastes (except 1003): burning of crop residues on the ground, but off site of the field - cereal and woody crops (prunes of olives and wine)

SNAP 1003 Stubble burning: burning of crop residues on field - cereal crops

In climate reporting, the same distinction has been maintained, with emissions from open burning included in 5C2 open burning of waste - biogenic -other and stubble burning in 3F Field burning of agricultural residues of the CRF

National methodology applied for open burning of agricultural residues

A **Tier 2 approach** has been used. Parameters taken into consideration are the following:

-**removable residues** (t), estimated with annual crop production and removable residues/product ratio

-**dry residues** in removable residue (t dry matter), calculated with amount of removable residues and fraction of dry matter

-**burnt fraction** of removable residues (the complementary fraction is removed for feeding, bedding, etc.)

(removable dry residue burned for **heating**)

-removable **dry residues oxidized** (t dry matter), assessed with amount of dry residues in the removable residues, burnt fraction of removable residues and fraction of residues oxidized during burning

-**carbon content in removable residues** burning release in air (t C), calculated with the amount of removable dry residue oxidized and the fraction of carbon from the dry matter of residues

-**nitrogen content in removable residues** burning release in air (t N), calculated with the amount of removable dry residue oxidized and the fraction of nitrogen from the dry matter of residues. The fraction of nitrogen has been calculated considering raw protein content from residues (dry matter fraction) divided by 6.25

All these parameters refer both to the country-specific values and IPCC Guidelines

Default methodology for burning of agricultural residues

-Tier 1 default approach for 5.C.2 Open burning of waste - GB 2019

$$E_{pollutant} = AR_{production} \times EF_{pollutant}$$

-Tier 1 default approach for 3.F Field burning of agricultural wastes (stubble burning) - GB 2019

$$E_{pollutant} = AR_{residue_burnt} \cdot EF_{pollutant}$$

-Tier 1 method for non-CO2 greenhouse gas emissions from biomass burning - IPCC 2006 (V4 Ch5 cropland and Ch2)

EQUATION 2.27

ESTIMATION OF GREENHOUSE GAS EMISSIONS FROM FIRE

$$L_{fire} = A \cdot M_B \cdot C_f \cdot G_{ef} \cdot 10^{-3}$$

Where:

L_{fire} = tonnes of GHG emissions from fire

A = area burnt, ha

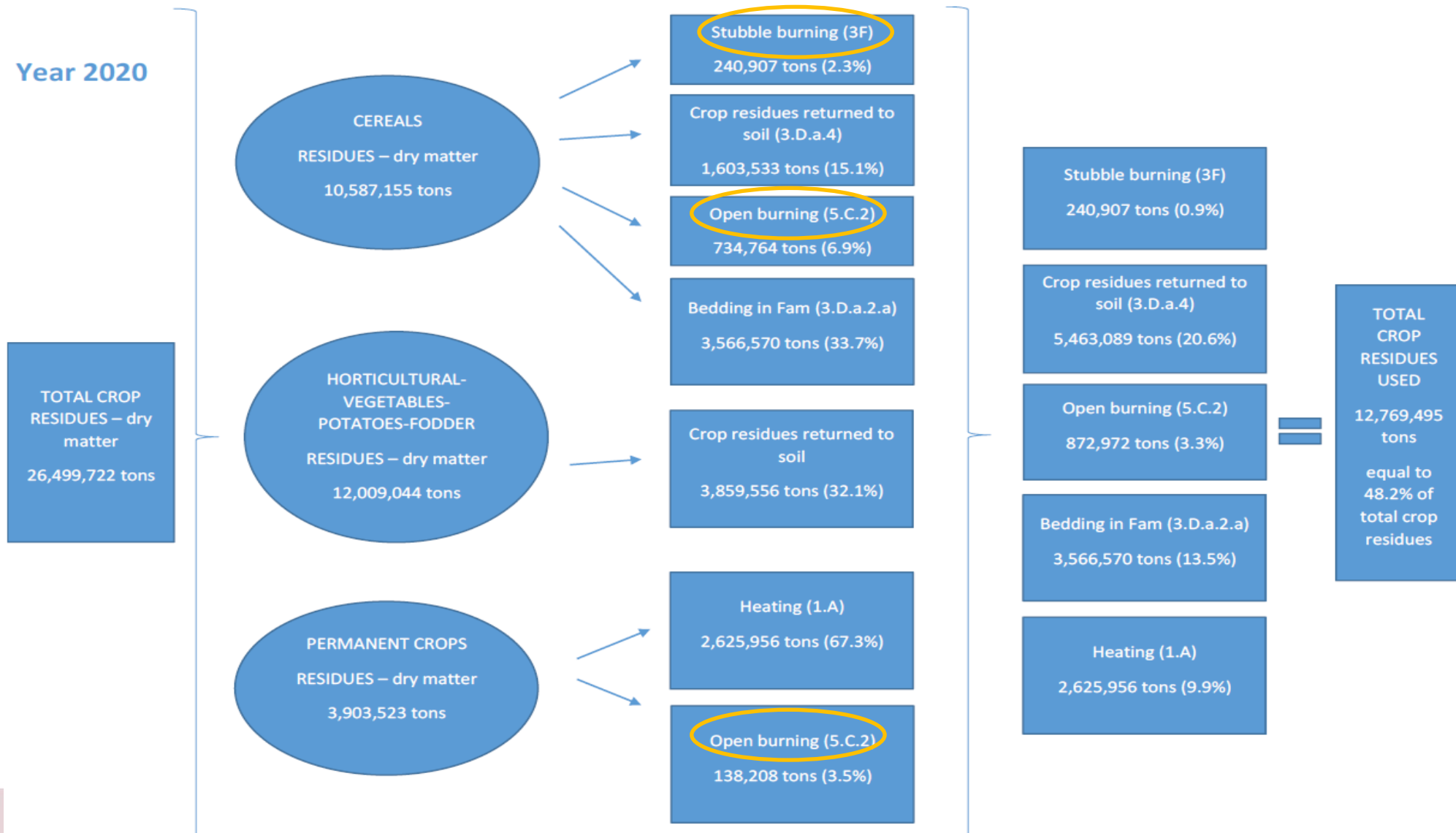
MB = mass of fuel available for combustion, t ha⁻¹

Cf = combustion factor

Gef = emission factor, g kg⁻¹ dry matter burnt

Different uses of agricultural residues

Figure A.7.1. Flow-chart on the amount of crop residues generated and shares of the crop residue amounts used for different purposes



Emission factors - pollutants and GHGs

-NO_x, CO, NMVOC: IPCC 1997

NO_x, CO EFs are in the range of the tier 1 EFs of the GB 2019

-PM10, PM2.5: USEPA (EPA, 1995) for stubble burning; EMEP/CORINAIR 2007 and TNO 2001 for open burning

-BC, NH₃, SO₂, HM, PCDD/F, PAH: EMEP/EEA GB 2019; NH₃ EF not available for open burning

For HM, PAH, BC tier 2 EFs have been used

-N₂O, CH₄: IPCC 1997

IPCC emission factors used (IPCC, 1997) are the ratios of carbon or nitrogen compounds (i.e. C-CH₄ or N-N₂O), that are mass of carbon or nitrogen compound released relative to mass of total carbon or nitrogen released from burning. These last values have been calculated using the fractions of carbon or nitrogen of dry matter of residues, differentiated by crops. IEFs are consistent with EFs 2006 IPCC Guidelines

Other types of waste open burning exist in Italy

- CO₂ emissions from open burning of waste are estimated too, while CH₄ and N₂O emission factor are under investigations.
- Open burning of waste is forbidden in Italy but sometimes it illegally occurs.
- Estimates are based on 2006 IPCC Guidelines:

EQUATION 5.7

TOTAL AMOUNT OF MUNICIPAL SOLID WASTE OPEN-BURNED

$$MSW_B = P \cdot P_{frac} \cdot MSW_P \cdot B_{frac} \cdot 365 \cdot 10^{-6}$$

EQUATION 5.2

CO₂ EMISSION ESTIMATE BASED ON THE MSW COMPOSITION

$$CO_2 \text{ Emissions} = MSW \cdot \sum_j (WF_j \cdot dm_j \cdot CF_j \cdot FCF_j \cdot OF_j) \cdot 44/12$$

- Pfrac (fraction of “rural people”) < 10%
- Bfrac (rate of the waste amount that is burned relative to the total amount of waste treated on the bases of recent national data) = 0.4%
- 1990-2009 CO₂ E.F. for Municipal Solid Waste (MSW) calculated considering a carbon content equal to 23% and a fossil quota equal to 35%;
- 2010-2020 CO₂ E.F. for Municipal Solid Waste (MSW) calculated considering a carbon content equal to 25,5% and a fossil quota equal to 50%;

Car and building fires (5E)

Buildings subdivided into 4 subcategories:

- detached house
 - undetached house
 - apartment buildings
 - industrial buildings
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- The distribution of population in the different typology of building has been derived from Eurostat.
 - Data regarding the number of car and building fires have been derived from the Annually statistics of fire service in Italy.
 - **TSP, PM10, PM2.5**, and **PCDD/F** EFs are from the Norwegian Emission Inventory 2007 (Aasestad, 2007), coherent with the Guidebook EMEP/EEA.
 - **Black Carbon** EF has been derived from 2004 IIASA report “Primary Emissions of Submicron and Carbonaceous Particles in Europe and the Potential for their Control”.
 - **Cd, Hg** and **Pb** emissions have been estimated for this source on the basis of 2019 EMEP/EEA Guidebook.
 - From 1990 to 2000 data have been reconstructed on the basis of the population (NO data about car and building fires available).

Gaps in the EMEP/EEA methodology

-Old and non-European specific emission factors for burning of agricultural waste

PM EFs of the GB refer to the same period and to the same country (Jenkins et al, 1996 - USA) of the EFs used in the Italian inventory (USEPA 1995)

-Further details could be inserted in GB for estimating activity data for open burning of agricultural waste

-Emission factors for category 5E – Car and Building Fires seems to be unreliable or not fitting to the Italian context. In particular, the emission factors reported in the EMEP/EEA Guidebook “used for particles in the inventory are given by scaling the emission factors used for combustion of fuelwood in the households” (Aasestad, 2007) but the Italian buildings are made up of the vast majority of reinforced concrete

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