11.B - Forest Fires

Short Description

Method	AD	EF	Key Category
CS, T2, T1	CS	D	*not included in key category analysis*

Category *11.B – Forest fires* include emissions from forest fires occurring naturally or caused by humans.

In Germany's forests prescribed burning is not applied. Therefore, all forest fires are categorized as wildfires. - Note that emissions reported here are not accounted for the national totals.

Methodology

For calculating the emissions of wildfires a country specific Tier2 approach was used. The mass of carbon emitted M(C) was calculated using the adapted equation follows the methodology of Seiler and Crutzen (1980) [1].

$M(C) = 0.45 * A * B * β$

where:

0.45 = average fraction of carbon in fuel wood;

A = forest area burnt in [m²];

B = mean above-ground biomass of fuel material per unit area in [kg/m²];

β = burning efficiency (fraction burnt) of the above-ground biomass.

The data on forest areas burnt for the period 1990 to 2018 have been taken from the German forest fire statistic (BLE, 2020) [2] managed by the Federal Agency for Agriculture and Food. The mean above-ground biomass was derived for each year by linear extrapolation and interpolation between the German National Forest Inventorys of 1987, 2002, 2012 (Bundeswaldinventuren 1987, 2002, 2012), the inventory study 2008 (https://www.thuenen.de/en/wo/projects/forest-monitoring/greenhouse-gas-inventory-for-forests/inventory-study-2008/ Inventurstudie 2008]) and the carbon inventory 2017 (https://www.thuenen.de/en/wo/projects/forest-monitoring/greenhouse-gas-inventory-for-forests/carbon-inventory-2017/ Kohlenstoffinventur 2017]). Pursuant to König (2007) [3], 80% of the forest fires in Germany are surface fires and 20% crown fires. In accordance to the IPCC Good Practice Guidance for LULUCF (2003) a burning efficiency of 0.15 was used for surface fires and an efficiency of 0.45 was used for crown fires.

The emissions for the pollutants were calculated by multiplying the mass of carbon with the respective emission factors from

table 3-3 (EMEP/EEA, 2019) [4].

For the calculation of particulate emissions (TSP, PM_{10} and $PM_{2.5}$) the burnt biomass was multiplied with the respective emission factors from table 3-5 (EMEP/EEA, 2019). Those particulate emission factors have been estimated by averaging the emission factors from the US Environmental Protection Agency (USEPA, 1996) [5] methodology, since no better information is available. Those emission factors are assumed to be the same for all types of forest.

The Guidebook does not indicate whether EFs have considered the condensable component (with or without).

As a first estimate black carbon emissions are reported the first time.

Activity data

The data on forest areas burnt for the period 1990 to 2019 are based on the German forest fire statistic (BLE, 2020) managed by the Federal Agency for Agriculture and Food.

Table 1: Area of forest burnt, in [ha]

	1990		1991		1992	1993		1994			1995	1996	1997	1998	1999	2000
1606	920	4908	1493	1114	592	1381	599	397	415	581						

Emission factors

For the year 2018 the estimated emission factors from table 2 were applied.

Table 2: Emission factors applied for 2018

~ Pollutant	~ EF,,2018,, [kg/ha forest area burnt]
NO,,x,,	> 123.63
CO	> 4,409.60
NMVOC	> 389.45
SO,,x,,	> 29.67
NH,,3,,	> 33.38
TSP	> 700.59
PM,,10,,	> 453.32
PM,,2.5,,	> 370.90
BC	> 33.38

In addition, a large-scale fire, which occurred in September 2018, is reported under 11.B. A detailed description can be found in the NIR 2020 in Chapter 6.8.2.5 [6], because a large amount of CO_2 emissions were released.

The burned area of the drained moor, which is used as a military facility, covered 1,221 ha. This fire was extensively investigated and documented by the Federal Office for Infrastructure, Environmental Protection and Services of the German Armed Forces. The emissions are calculated according to IPCC GL (2006), chapter 2, form 2.27 [7] . The product MB×Cf is set to 336 t dm ha-1 according to Table 2.6 and formula 2.7 2013 IPCC Wetlands Supplement [8], i.e. it is assumed that the moor was completely drained during the fire.

For the calculation of CO emissions the EF according to Table 2.7, 2013 IPCC Wetlands Supplement 207 g (kg dm)-1, is taken into account. This results in 85 kt CO. For other emissions from land fires on drained organic soils no Tier-1 emission factors exist and are therefore not reported (NO)".

bibliography : 1 : BLE (Bundesanstalt für Landwirtschaft und Ernährung), 2019: Waldbrandstatistik der Bundesrepublik Deutschland für das Jahr 2018, Bonn: 21 S. : 2 : EMEP/EEA, 2013: [*https://www.eea.europa.eu/publications/emep-eea-guidebook-2013 EMEP/EEA air pollutant emission inventory guidebook – 2013. 11.B Forest Fires.] : 3 : König, H.-C., 2007. Waldbrandschutz - Kompendium für Forst und Feuerwehr. 1. Fachverlag Matthias Grimm, Berlin, 197 S. : 4 : Seiler, W., Crutzen P.J.: Estimates of gross and net fluxes of carbon between the biosphere and the atmosphere from biomass burning. Climate Change. 1980 : 5 : USEPA, 1996: Compilation of Air Pollutant Emission Factors Vol.1. Stationary, Point and Area Sources. Report AP-42 (fifth edition). :6: NIR (2020): National Inventory

Report 2020 for the German Greenhouse Gas Inventory 1990-2018. Available in April 2020. :7: IPCC (Intergovernmental Panel on Climate Change) (2006): 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use. Eds.: Eggleston S., Buendia L., Miwa K., Ngara T., Tanabe K. (Eds). IEA/OECD, IPCC National Greenhouse Gas Inventories Programme, Technical Support Unit, Hayama, Kanagawa, Japan. <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html> [zitiert am 03.09.2015] :8: IPCC (Intergovernmental Panel on Climate Change) (2014b): 2013 Supplement to the IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. Hiraishi, T., Krug, T., Tanabe, K., Srivastava, N., Baasansuren, J., Fukuda, M. and Troxler, T.G.(eds). Published: IPCC, Switzerland <http://www.ipcc-nggip.iges.or.jp/public/wetlands/index.html> [zitiert am 03.09.2015] bibliography

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[1] (bibcite 4)
[2] (bibcite 1)
[3] (bibcite 3)
[4] (bibcite 2)
[5] (bibcite 5)
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[8] (bibcite 8)