
Dataset Information:

Title	Manure applied to soils
Abstract	Greenhouse gas (GHG) emissions from manure applied to soils consist of nitrous oxide gas from nitrogen additions to managed soils from treated manure. Computed at Tier 1 following the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC,2006); available by country, with global coverage and relative to the period 1990-2010, with annual updates.
Supplemental	This domain contains data on GHG emissions, associated emission factors and underlying activity data. The FAOSTAT Emissions data are estimates by FAO and do not coincide with GHG data reported by member countries to UNFCCC. The database is intended primarily as a service to help member countries assess and report their emissions, as well as a useful international benchmark. The FAOSTAT Emissions data are disseminated publicly to facilitate continuous feedback from member countries.
Creation Date	2012
Last Update	2012
Data Type	Climate Change - Greenhouse Gases
Category	Environment
Time Period	1990 - 2010
Periodicity	Annual
Geographical Coverage	World
Spatial Unit	Country
Language	Multilingual (EN, FR, ES)

Methodology and Quality Information:

Methods and processing	<p>GHG emissions from manure applied to soils consist of direct and indirect nitrous oxide (N₂O) emissions from manure nitrogen (N) added to agricultural soils by farmers. Specifically, N₂O is produced by microbial processes of nitrification and de-nitrification taking place on the application site (direct emissions), and after volatilization/re-deposition and leaching processes (indirect emissions). The FAOSTAT data are estimated at Tier 1 following the IPCC, 2006, Vol. 4, Ch. 10 and 11.</p> <p><u>Direct emissions</u> are estimated at country level, using the formula:</p> $Emission = A * EF$ <p>where:</p> <p><i>Emission</i> = GHG emissions in kg N₂O-N yr⁻¹; <i>A</i> = Activity data, representing the total amount of N in manure applied to soils in kg N yr⁻¹ (1); <i>EF</i> = Tier 1, default IPCC emission factors in kg N₂O-N/kg N yr⁻¹ (2).</p> <p>(1) It is the amount of N excreted (see below, note <i>i</i>) by livestock (<i>ii</i>), treated in manure management systems (MMS) (<i>iii</i>) and net of losses through volatilization, runoff and leaching from MMS, and other human use (<i>iv</i>), plus the N contribution from bedding materials when present (<i>v</i>).</p> <p>(<i>i</i>) Following IPCC,2006: Vol.4, Ch. 10, Eq. 10.30, the total amount of N excreted by each livestock category is calculated multiplying the number of livestock heads by two coefficients: a) the Typical Animal Mass (TAM) and b) the N excretion coefficient (N_{ex}). Both parameters vary according to geographic region. TAM values are obtained from IPCC, 2006: Vol.4, Ch. 10, Annex 10A.2 Tabs. 10A-4 to 10A-9; N_{ex} values are derived from IPCC, 2006: Vol.4, Ch. 10, Tab. 10.19.</p> <p>(<i>ii</i>) Data for buffalo, sheep, goats, ducks, turkeys, chickens, dairy cattle*, market swine**</p>
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and breeding*** swine are taken directly from FAOSTAT (domain: Production), non-dairy cattle is derived from FAOSTAT categories, specifically as: cattle minus dairy cattle.

*FAOSTAT livestock data include cattle and dairy cattle. Dairy cattle data are expressed as heads of cows producing milk, and can be found under the domain: Production/Livestock primary/producing animals cow milk, whole fresh.

** Calculated as 10% of FAOSTAT category pigs (IPCC, 2006, Vol.4, Ch.10, Tab.10.19).

*** Calculated as 90% of FAOSTAT category pigs (IPCC, 2006, Vol.4, Ch.10, Tab.10.19).

(iii) Default IPCC percentages of total N treated in different MMS, by region and livestock category, are taken from IPCC, 2006: Vol.4, Ch. 10, Annex 10A.2 Tabs. 10A-4 to 10A-9 (for poultry: IPCC, 1997: Vol. 3, Ch.4, Tab. 4.21).

(iv) Default IPCC values for total N losses from different MMS depend on the livestock category as per IPCC, 2006: Vol.4, Ch. 10, Tab. 23. Losses of treated manure due to use for construction, feed or fuel are set to zero, as per IPCC, 2006: Vol.4, Ch. 11, page 11.13. It is assumed that all treated manure, net of the above losses, is applied to soils following IPCC, 2006: Vol.4, Ch. 11, page 11.13.

(v) Default amounts of N used in bedding (for solid storage and deep bedding) as per IPCC, 2006: Vol.4, Ch. 10, page 10.66.

(2) Global IPCC default EF values are taken from IPCC, 2006: Vol. 4, Ch. 11, Tab. 11.1.

Indirect emissions are estimated at country level, using the formula:

$$Emission = A * EF$$

where:

Emission = GHG emissions in kg yr⁻¹;

A = Activity data, representing the fraction of manure N applications that volatilizes as NH₃ and NO_x and is lost through runoff and leaching in kg N yr⁻¹ (3);

EF = Tier 1, default IPCC emission factors in kg N₂O-N / kg N yr⁻¹ (4).

(3) Obtained through the volatilization and leaching factors in IPCC, 2006: Vol.4, Ch. 11, Tab. 11.3.

(4) Global IPCC default EF values from IPCC, 2006: Vol.4, Ch. 11, Tab. 11.3.

Dimensionless conversion factors used are:

10⁻³, to convert the activity data from kg to tonnes;

44/28, to convert the emissions from kg N₂O-N to kg N₂O gas;

10⁻⁶, to convert the emissions from kg N₂O to Gg N₂O; and

GWP-N₂O = 310 (100-year time horizon global warming potential), to convert Gg N₂O to Gg CO₂eq (IPCC, 1996: Technical Summary, Tab. 4 pg. 22).

The manure applied to soils domain contains the following data categories available for download: country-level GHG emissions, provided as total, direct and indirect amounts in both Gg N₂O and Gg CO₂eq; implied emission factors; and activity data. Data is available for 220 individual countries and territories, as well as for standard FAOSTAT regional aggregations, plus Annex I and non-Annex I groups. The data period is 1990-2010, with annual updates.

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. In the case of manure applied to soil more detailed information are available in the guidelines (IPCC, 2006: Vol.4, Ch. 11, Section 11.2.1.4 for direct emissions, and Section 11.2.2.4 for indirect emissions).

References

IPCC. 1996. Climate Change 1995 - The Science of Climate Change: Contribution of

Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge.

IPCC. 1997. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. OECD, Paris, France.

IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (Eds), IGES, Hayama, Japan.

Data Collection Method Computed

Completeness 100%

Links www.fao.org/climatechange/micca/ghg/
www.ipcc-nggip.iges.or.jp/public/

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