

## **Global Nitrous Oxide Budget 2020**

### **Japanese Press release: 7th October 2020 at 16:00 (UK time)**

Tsukuba, Japan

**Agricultural production contributed 82 % to the global anthropogenic N<sub>2</sub>O emission in the recent decade, highlighting the urgency to mitigate the impacts of our food system on climate change.**

On 7<sup>th</sup> October, a Nature scientific article reports on a continued increasing global N<sub>2</sub>O emission over the past four decades. The increase is primarily driven by human-induced emissions which has risen by 30% over the period. Overall, agricultural activities dominated the growth in the emissions with the use of Nitrogen fertilizers in agriculture including livestock manure production.

The highest growth rates in N<sub>2</sub>O emissions come from emerging economies, particularly Brazil, China, and India, where there have been large increases in crop production and livestock numbers.

The findings underscore the urgency to mitigate N<sub>2</sub>O emissions in our food production system. The study shows N<sub>2</sub>O emissions are increasing as fast as or faster than the most pessimistic emission scenarios developed by the IPCC, which lead to global mean temperatures well in excess of 3C.

The **global nitrous oxide budget** is an inventory, analysis and synthesis of the greenhouse gas across all sectors and regions. It is produced by a group of international scientists working under the umbrella of Global Carbon Project (GCP). The researchers employed state-of-the-art bottom-up (BU: inventory, statistical extrapolation of flux measurements, process-based land and ocean modeling) and top-down (TD: atmospheric inversions) emission estimation approaches. The results provide the most comprehensive quantification of global N<sub>2</sub>O sources and sinks resulting from 21 natural and human sectors during 1980-2016 (See Figure 1).

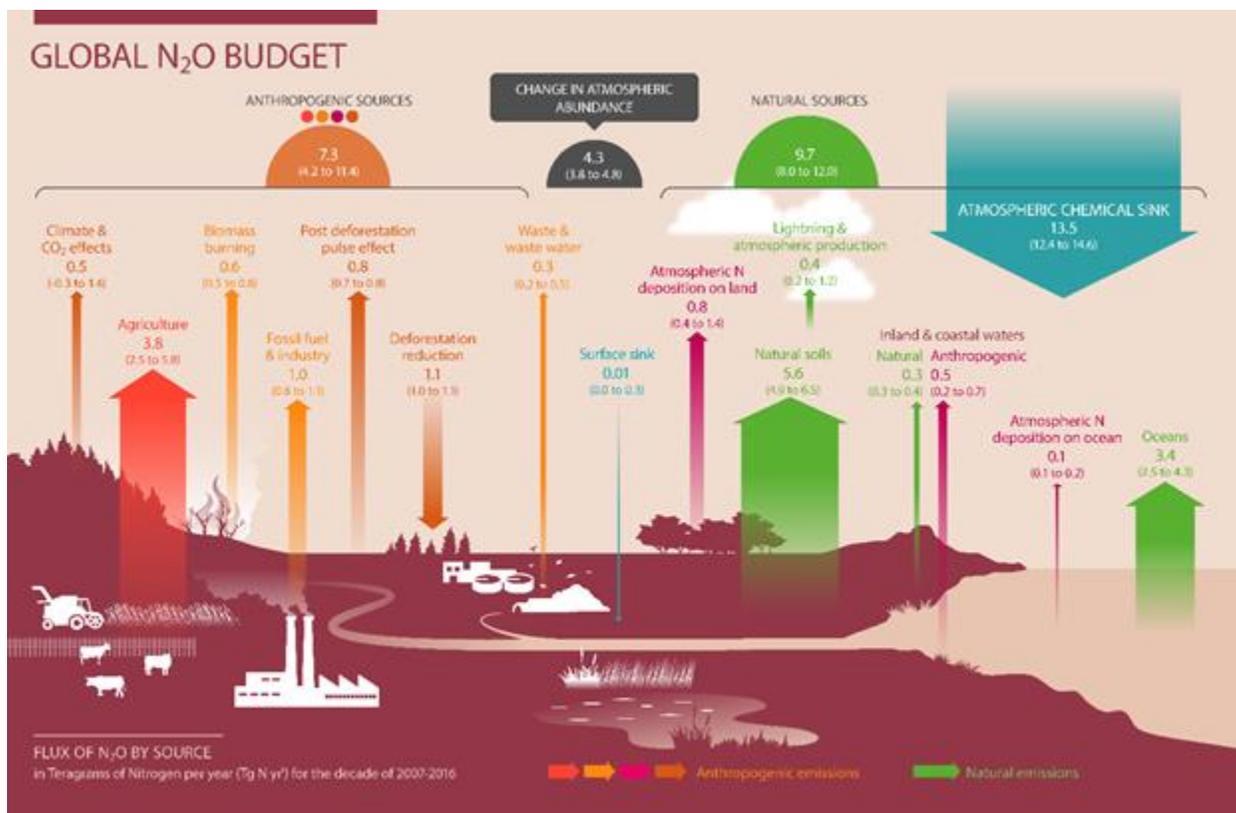


Figure 1: Global nitrous oxide Budget 2007 - 2016 ( source)

Note: The red arrow represents direct emissions of N additions in the agricultural sector (Agriculture). The orange arrows represent emissions from other direct anthropogenic sources. The maroon arrows represent indirect emissions from anthropogenic N additions. The brown arrows represent perturbed fluxes from climate/CO<sub>2</sub>/land cover change effects. The green arrows represent natural sources and sinks. The anthropogenic and natural N<sub>2</sub>O sources are derived from BU estimates. The blue arrows represent surface sink and observed atmospheric chemical sink of which about 1% occurs in the troposphere. The total budget (sources + sinks) does not exactly match the observed atmospheric accumulation, because each of the terms has been derived independently and we do not force top-down agreement by rescaling the terms. This imbalance readily falls within the overall uncertainty in closing the N<sub>2</sub>O budget, as reflected in each of the terms. The N<sub>2</sub>O sources and sinks are given in Tg N yr<sup>-1</sup>

## Background

Nitrous oxide (N<sub>2</sub>O) is one of the primary greenhouse gases that contribute toward global warming. Nitrous oxide is less-well recognised than other greenhouse gases, such as carbon dioxide and methane, even though it is more potent than carbon dioxide and has a depletion effect on the stratospheric ozone layer. Over the years, the level of N<sub>2</sub>O has increased by over 20% from 270 parts per billion (ppb) in 1750 to 331 ppb in 2018. The increase is expected to continue in the coming decades and could double by 2050 due to the growing demand for food, feed, fiber and energy, and a rising source from waste generation and industrial processes. Despite its importance, there is a lack of study that provides a full picture of global N<sub>2</sub>O emissions

and the interactive effects between nitrogen (N) additions and the biochemical processes that control N<sub>2</sub>O fluxes (i.e. dynamic exchange between different N<sub>2</sub>O sources and sinks).

### **International collaboration, with contributions from Japan**

The Global Nitrous Oxide Budget is part of the Global Carbon Project (GCP)'s efforts to develop a complete picture of the Greenhouse gases cycle by establishing complete, consistent scientific knowledge to support policy debate and actions to mitigate greenhouse gas emissions to the atmosphere, and will continue to be regularly updated with the most recent and reliable scientific findings.

The study was conducted by an international research team of 70 scientists & 44 research organizations from around the world. These include two scientists from NIES and JAMSTEC in Japan.

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**The Global Carbon Project** is an international research project within the Future Earth research initiative on global sustainability. It aims to develop a comprehensive picture of the global carbon cycle, including both its biophysical and human dimensions together with the interactions and feedbacks between them.

**NOTES: Press release: EMBARGO: Wednesday 7th October 2020 at 4pm UK time.**

#### **1. Contact point**

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#### **2. Social Media**

- Twitter: @gcarbonproject,
- Facebook: <https://www.facebook.com/globalcarbonproject>

### 3. Publications:

This press release is part of the Global Nitrous Oxide Budget 2020, the periodical update by the Global Carbon Project. It is based on the analyses:

- Tian et al. (2020) A comprehensive quantification of global nitrous oxide sources and sinks. Nature. <https://doi.org/10.1038/s41586-020-2780-0>

### Access to the data:

Data for the Global Nitrous Oxide Budget is available from the Global carbon Atlas, with budgets by regions and sectors. For the release of the global nitrous oxide budget, the Global Carbon Atlas includes a new design and new applications related to the Global Carbon Project: CO<sub>2</sub> emissions for 343 cities worldwide, and carbon cycle and natural CO<sub>2</sub> emissions from rivers and lakes.

- <http://www.globalcarbonproject.org>
- <http://www.globalcarbonatlas.org>

### 4. Events:

Scientists from Japan who are involved in this international research collaboration will present the research findings and their expertise in a one-day event on 29th October 2020. The event consists of the morning session and the afternoon session. In the morning session (only in Japanese), the research findings will be presented in an accessible manner, suitable for anyone who is interested in the topic. The afternoon session will be presented in English to further learn in detail about the research and the wider implications of its finding, particularly on our current food production system. Both events are free of charge but required pre-registration (see detail below).

**4a) Morning session (only in Japanese): Thursday, 29<sup>th</sup> October 2020 09:30~11:30**

**4b) Afternoon session (only in English): Thursday, 29<sup>th</sup> October 2020 13:00 ~ 15:30**

Free of charge:

**Registration for both events:** <https://bit.ly/2EA3hod>

### ***Organizing Secretariat for Global Nitrous Oxide Budget Seminar 2020, Tsukuba, Japan***

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### 5. Access to material:

- Data and figures: <https://www.globalcarbonproject.org>