

Global Carbon Project  
Briefing on key messages Global Carbon Budget 2025  
**EMBARGO until 00:01 GMT (London time) Thursday November 13**  
(21:01 Belem time Wednesday November 12)

**Important notice:** this document is intended as a background briefing for the co-authors and journalists covering the release of the Global Carbon Budget 2025. **Do not cite or quote until after the embargo.**

The Global Carbon Project is an international research project within the Future Earth research initiative on global sustainability, and a research partner of the World Climate Research Programme. It aims to develop a complete picture of the global carbon cycle, including both its biophysical and human dimensions, together with the interactions and feedbacks between them. The Global Carbon Budget 2025 is the 20<sup>th</sup> edition of the annual update, which started in 2006, and the 14<sup>th</sup> edition with data made available as a living data collection in the journal *Earth System Science Data*.

Data and methods are detailed in the publications (see links provided at the end of this document).

**A. Headline:**

**Fossil CO<sub>2</sub> emissions continue to rise in 2025 while the terrestrial sink recovers to pre-El Niño strength**

- **Global CO<sub>2</sub> emissions from fossil use are projected to rise 1.1% in 2025 (range 0.2% to 2.2%).** Emissions in China and India are projected to grow much less in 2025 compared to their growth over the past decade<sup>1</sup>, while emissions in the USA and European Union are also projected to grow this year, partly due to weather conditions.
- **Global CO<sub>2</sub> emissions from land-use change are expected to decrease in 2025, driven by reductions in deforestation and degradation fires in South America.** Land-use change emissions have decreased since their peak in the late-1990s, in particular in the past decade.
- **Total anthropogenic CO<sub>2</sub> emissions – the sum of fossil and land-use change emissions – have grown more slowly in the past decade<sup>1</sup> (0.3% per year on average), compared to the previous decade (1.9% per year).** Total emissions are projected to be 42.2 billion tonnes of CO<sub>2</sub> in 2025, with the growth in fossil emissions offset by the decrease in land-use change emissions.
- **The remaining carbon budget to limit global warming to 1.5°C is virtually exhausted.** With a warming of the planet attributed to human activities of 1.36°C in 2024, the remaining budget for 1.5°C is 170 GtCO<sub>2</sub>, equivalent to 4 years at the 2025 emissions levels.
- **The land CO<sub>2</sub> sink is set to recover to its pre-El Niño strength in 2025, after a strong decrease in 2024.** Based on a consolidation of the global carbon budget methodology, the land and ocean have taken up 21% and 29% of anthropogenic emissions in the past decade, respectively.
- **The concentration of CO<sub>2</sub> in the atmosphere is set to reach 425.7 parts per million in 2025.** Emerging climate impacts on the land and ocean carbon sinks contributed 8% to the rise in atmospheric CO<sub>2</sub> concentration since 1960.

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<sup>1</sup> 2015-2024

## B. CO<sub>2</sub> emissions

**Preliminary data for 2025 show global fossil CO<sub>2</sub> emissions are set to increase +1.1% (range 0.2% to 2.2%) relative to the 2024 level**

- **The projected 2025 rise brings global fossil CO<sub>2</sub> emissions to 38.1 billion tonnes of CO<sub>2</sub> (GtCO<sub>2</sub>)<sup>2</sup>.** Final data for 2024 show global fossil emissions also increased 1.1% above 2023 levels. Growth in global fossil CO<sub>2</sub> emissions remains persistent since the post-pandemic rebound in 2021.
- **The projected 2025 rise is driven by growth in all fuel types (coal, oil, and gas).**
  - Coal emissions are projected to increase by 0.8% (range -0.1% to 1.9%), with increases in the USA, India and the Rest of the World in aggregate<sup>3</sup>, and decreases in the European Union (EU27).
  - Oil emissions are projected to increase by 1.0% (range 0.3% to 1.8%), with increases in all major world regions.
  - Natural gas emissions are projected to increase 1.3% (range 0.0% to 2.5%), with increases in China, the USA, the EU27, and the Rest of the World, and a decrease in India. Natural gas emissions appear to be returning to the persistent growth trend before the Russian invasion of Ukraine.
- **Emissions are projected to grow in the USA and the European Union, contrary to their long-term declining trends, and also in China and India, albeit more slowly compared to recent trends**
  - In China (32% of global emissions), emissions in 2025 are projected to increase by 0.4% (range -0.9% to 2.0%) over 2024, below their growth over the past decade for the second year in a row (see Table 3). Given the uncertainty range, a decrease in emissions is also a possibility - confirmation will require full-year data, expected in 2026. The low emission growth expected in 2025 is due to moderate growth in energy consumption combined with an extraordinary growth in renewable power generation. As a result, coal consumption is stagnant.
  - In the United States (13% of global emissions), emissions in 2025 are projected to increase by 1.9% (-0.2% to 4.1%) over 2024, significantly above recent trends (Table 3). A colder start to the year after a mild 2024 led to greater heating requirements, while higher natural gas prices resulting largely from increased liquefied natural gas (LNG) export capacity led to more coal being used in power generation. These were compounded by an increase in total demand for electricity.
  - In India (8% of global emissions), emissions in 2025 are projected to increase by 1.4% (-0.3% to 3.1%) over 2024, significantly below recent trends (Table 3). An early monsoon with the highest-ever May rainfall substantially reduced cooling requirements in May and June, the hottest months of the year. Combined with strong growth in renewables,

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<sup>2</sup> Global fossil CO<sub>2</sub> emissions include the cement carbonation sink.

<sup>3</sup> Emissions are described here for the largest emitting countries (China, USA, India), the European Union (EU27) in aggregate, International shipping and aviation (IAS), and the Rest of the World in aggregate. See also Table 1.

particularly solar power, this has led to very low growth in coal consumption in 2025.

- In the EU27 (6% of global emissions), emissions in 2025 are projected to increase by 0.4% (-2.1% to 2.8%) over 2024, significantly above recent trends (Table 3). Given the uncertainty range centred around zero, the increase should not be overinterpreted and will need to be confirmed when full-year data are available. While coal use continues to decline and solar power expands, weather-related low hydropower and wind generation have led to an increase in electricity generation from natural gas. In addition, a relatively cold February led to increased use of natural gas for space heating.
  - Projected emissions in Japan (2.5% of global emissions), provided this year for the first time, are for a decrease of 2.2% (-8.1% to 3.7%). This decrease builds on recent trends in the reactivation of nuclear power plants and the expansion of solar power generation, along with weak growth in the economy.
  - Emissions are projected to increase by 6.8% for international aviation (1.5% of global emissions), exceeding pre-COVID levels for the first time, but to remain flat for international shipping (1.6% of global emissions).
  - For the Rest of the World in aggregate (38% of global emissions), emissions in 2025 are projected to increase by 1.1% (-1.1% to 3.3%) over 2024.
- **Decarbonisation of energy systems is progressing in many countries, including in China, the European Union, the USA, and globally, but not enough to offset the growth in energy demand**
    - The fossil fuel carbon intensity of energy has consistently decreased (indicating decarbonisation of energy systems) over the past decade in China, the USA, the EU27, and to a lesser extent, globally. For fossil CO<sub>2</sub> emissions to peak and decline, these trends need to offset the growth in energy demand, which is the case in the USA and EU27, but not yet in China or globally. Energy demand is growing faster than expected in China, the USA, and globally, due to persistent GDP growth and slower declines in energy per GDP.
    - 35 countries have decreased their fossil CO<sub>2</sub> emissions significantly ( $p < 0.05$ ) while growing their economies in the decade 2015-2024<sup>4</sup>, twice as many as during the previous decade (2005-2014; 18 countries)<sup>5</sup>. These 35 countries account for 27% of global fossil CO<sub>2</sub> emissions.

**Net CO<sub>2</sub> emissions from land-use change<sup>6</sup> remain high, but they have decreased since their peak in the late-1990s, in particular in the past decade**

- **Global net CO<sub>2</sub> emissions from land-use change averaged 5.0 GtCO<sub>2</sub> per year for the past**

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<sup>4</sup> Andorra, Australia, Austria, Belgium, Bulgaria, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Jordan, Latvia, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, South Korea, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Taiwan, Thailand, United Kingdom, and USA.

<sup>5</sup> The following countries were added to the list in 2015-2024 compared to 2005-2014: Andorra, Australia, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Israel, Jordan, Latvia, Norway, Poland, Portugal, South Korea, Slovenia, Spain, Taiwan, Thailand. The following countries were removed: North Macedonia and Uzbekistan.

<sup>6</sup> Net CO<sub>2</sub> emissions from land-use change refer to emissions, but also removals, from land-use, land-use change and forestry, such as deforestation, reforestation and afforestation, and forest management.

### **decade (2015-2024).**

- Emissions from permanent deforestation, the main driver of global gross sources from land-use change, remain high at around 3.9 GtCO<sub>2</sub> per year over the 2015-2024 period. Permanent removals through re/afforestation offset around half of the permanent deforestation emissions (2.2 GtCO<sub>2</sub> per year).
  - Brazil, Indonesia, and the Democratic Republic of the Congo together contribute 57% of the global net land-use change CO<sub>2</sub> emissions.
  - The largest carbon uptake through re/afforestations occurs in China, the USA, and the EU27, with combined removals of 0.9 GtCO<sub>2</sub> per year. Substantial uptake through re/afforestation also occurs in other regions such as Brazil, Russia, or Indonesia, where it is, however, outweighed by emissions from deforestation and other land-use changes.
  - Net land-use change CO<sub>2</sub> emissions were revised upwards compared to previous budgets (by 0.4 GtCO<sub>2</sub> annually in the past decade), after methodological improvements including taking into account changes in biomass densities in response to changes in environmental conditions over time.
- **Net emissions from land-use change have decreased at an annual rate of around 0.7 GtCO<sub>2</sub> per decade since the late 1990s, with a larger drop within the most recent decade.** This trend is statistically significant.
    - Preliminary data suggests net emissions decreased to 4.1 GtCO<sub>2</sub> in 2025 driven by reductions in deforestation and degradation fires in South America, in part related to the end of the dry 2023-2024 El Niño conditions.

### **Total CO<sub>2</sub> emissions from fossil use and land-use change combined have grown more slowly in the past decade, compared to the previous decade**

- Total anthropogenic emissions have grown annually by 0.3% over the past decade (2015-2024), compared to 1.9% in the previous decade (2005-2014).
- Total CO<sub>2</sub> emissions were 42.4 GtCO<sub>2</sub> in 2024, with a slightly lower preliminary estimate of 42.2 GtCO<sub>2</sub> in 2025, but with large uncertainty precluding additional interpretation. The rise in fossil CO<sub>2</sub> emissions in 2025 is compensated by the decline in land-use change CO<sub>2</sub> emissions.

### **The remaining carbon budget to limit global warming to 1.5°C is virtually exhausted**

- For a 50% likelihood to limit warming below 1.5°C, the remaining budget is 170 GtCO<sub>2</sub>, equivalent to 4 years at the 2025 emissions levels, consistent with the warming of the planet attributed to human activities, which reached 1.36°C in 2024<sup>7</sup>.
- Each additional cumulative emission of about 180 GtCO<sub>2</sub> (about 4 years at the 2025 emissions levels) will lead to approximately 0.1°C of warming.
- The remaining carbon budgets to limit warming to 1.7°C and 2°C above the 1850-1900 level have

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<sup>7</sup> <https://essd.copernicus.org/articles/17/2641/2025/>

been reduced to 525 GtCO<sub>2</sub> (12 years at 2025 emissions levels) and 1055 GtCO<sub>2</sub> (25 years), respectively.

### **C. Atmospheric CO<sub>2</sub> accumulation and the natural carbon sinks**

#### **The land and ocean CO<sub>2</sub> sinks were re-evaluated based on stronger evidence and new understanding<sup>8</sup>**

- The ocean CO<sub>2</sub> sink was re-evaluated upwards. It has taken up 29% of the total emissions in the past decade (compared to 26% in previous budgets).
- The land CO<sub>2</sub> sink was re-evaluated downwards. It has taken up 21% of the total emissions in the past decade (compared to 29% in previous budgets).
- The re-evaluation of the land and ocean emissions and sinks this year resolved long-standing issues in the global carbon budget assessment using new data and understanding, and helped clarify the emergence of climate impacts on the natural sinks.

#### **The land and ocean sinks have been relatively stagnant for a decade or more, with a strong influence of climate change trends**

- The land and ocean CO<sub>2</sub> sink are 25% and 7% smaller, respectively, than they would have been without the effects of climate change and variability, on average for the 2015-2024 period. Combined, this is equivalent to the total sink (land and ocean) being nearly 20% smaller than otherwise.
- The ocean CO<sub>2</sub> sink has been relatively stagnant since 2016, largely in response to climate variability modulating the growing sink trend, but further affected by the ocean heatwave of 2023-2024 in the Northern Hemisphere. The preliminary estimate for 2025 is slightly below the 2024 level following the end of the El Niño conditions.
- The land CO<sub>2</sub> sink has been relatively stagnant since 2000, largely in response to climate variability and climate change offsetting the CO<sub>2</sub>-induced growth. After a substantially weaker land sink in 2024 due to the 2023-2024 El Niño conditions, the preliminary estimate for 2025 suggests a full recovery to pre-El Niño levels.
- So far in 2025, global fire CO<sub>2</sub> emissions have been approximately 20% lower than the 2015-2024 average due to low fire activity across the tropics<sup>9</sup>.

#### **The combined effects of climate change and deforestation turn Southeast Asian and parts of South American tropical forests from CO<sub>2</sub> sinks to sources**

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<sup>8</sup> Methodological improvements included the consideration of changing biomass densities for land-use change emissions, and new evidence for a stronger ocean CO<sub>2</sub> sink and a weaker land CO<sub>2</sub> sink. For a full description, see our paper in *Nature* ([dx.doi.org/10.1038/s41586-025-09802-5](https://doi.org/10.1038/s41586-025-09802-5)).

<sup>9</sup> Global fire CO<sub>2</sub> emissions are presented alongside the global carbon budget analysis to give an indication of their scale. Direct comparison cannot be made between the reported fire CO<sub>2</sub> emissions and other components of the budget (such as the land sink and land-use change emissions) as these components already account for some types of fires.

- The net land CO<sub>2</sub> flux can be decomposed in three contributions: the response to atmospheric CO<sub>2</sub> increase (and nitrogen deposition), the response to climate change (e.g., changes in temperature, rainfall), and deforestation and other land-use change.
- Globally, the land sink response to atmospheric CO<sub>2</sub> increase (11.7 GtCO<sub>2</sub>) is larger than the combined effects of climate change (2.8 GtCO<sub>2</sub>), and land-use change (5.0 GtCO<sub>2</sub>), for a net land CO<sub>2</sub> flux of 3.9 GtCO<sub>2</sub>, all annual averages over the past decade 2015-2024.
- The combined effect of climate change and land-use change is largest in the tropics, with large parts of South American and Southeast Asian tropical forests being a source of carbon.
- Climate impacts on ecosystems are the dominant causes of carbon losses in South America, while deforestation is the main driver of carbon losses in Africa and South-East Asia.
- Our findings reinforce the need to halt deforestation and to mitigate climate change to prevent an increasingly larger fraction of the terrestrial biosphere shifting from a sink of CO<sub>2</sub> to a source of CO<sub>2</sub>.

**The concentration of CO<sub>2</sub> in the atmosphere is set to reach 425.7 ppm in 2025, 53% above pre-industrial levels**

- Direct human influence has caused a rise in CO<sub>2</sub> concentration of just above 100 ppm from 1959 (when continuous atmospheric CO<sub>2</sub> observation started), out of which about 8 ppm (8% of the total rise) is due to the impact of climate change on the land and ocean sinks, according to our analysis.
- Atmospheric CO<sub>2</sub> concentration increased by a record-high 3.7 ppm in 2024, mainly due to the effect of the 2023/2024 El Niño conditions weakening the land sink. The preliminary 2025 estimate is for a rise of around 2.3 ppm, close to the decadal mean of 2.6 ppm, suggesting the land sink has largely returned to its pre-El Niño level.

**Table 1. Projected change in fossil CO<sub>2</sub> emissions by fuel type in million tonnes CO<sub>2</sub> (percent in parenthesis) for 2025 compared to 2024.** IAS stands for International aviation and shipping. RoW stands for Rest of the World in aggregate (excluding IAS). World values include cement carbonation and IAS.

Country	Total	Coal	Oil	Gas	Cement
World	+330 (+1.1%)	+90 (+0.8%)	+96 (+1.0%)	+78 (+1.3%)	+4 (+0.5%)
China	+21 (+0.4%)	+0 (+0.3%)	+31 (+2.1%)	+9 (+1.3%)	-19 (-2.8%)
USA	+82 (+1.9%)	+53 (+7.5%)	+17 (+1.1%)	+15 (+1.1%)	-3 (-8.0%)
India	+36 (+1.4%)	+29 (+1.7%)	-1 (+0.1%)	-10 (-6.4%)	+18 (+9.9%)
EU27	+2 (+0.4%)	-3 (-0.3%)	+4 (+0.6%)	+4 (+0.9%)	-3 (-4.1%)
Japan	-23 (-2.2%)	-13 (-3.1%)	-4 (-0.8%)	-6 (-2.7%)	-1 (-3.0%)
IAS	+41 (+3.7%)		+41 (+3.7%)		
RoW	+115 (+1.1%)	+23 (+1.0%)	+9 (+0.5%)	+66 (+1.8%)	+11 (+2.4%)

**Table 2. 2024 fossil CO<sub>2</sub> emissions from top 20 countries including the European Union (EU27; together and separately) in billion tonnes CO<sub>2</sub>/yr, and, when available, projection of growth for 2025.** World values include cement carbonation and IAS.

Country	2024 emissions (billion tonnes CO <sub>2</sub> /yr)	2024 % of total	2024 per capita (tonnes CO <sub>2</sub> /pers/yr)	2024 growth (percent)	2025 projected growth (percent)
World	37.8	100%	4.7	1.1%	1.1% (0.2% to 2.2%)
China	12.3	31.7%	8.6	0.7%	0.4% (-0.9% to 2%)
USA	4.9	12.7%	14.2	-0.6%	1.9% (-0.2% to 4.1%)
India	3.2	8.3%	2.2	4.0%	1.4% (-0.3% to 3.1%)
EU27	2.4	6.3%	5.4	-2.6%	0.4% (-2.1% to 2.8%)
Russia	1.8	4.6%	12.3	2.5%	n.a.

Japan	1.0	2.5%	7.8	-2.5%	-2.2% (-8.1% to 3.7%)
Indonesia	0.8	2.1%	2.9	6.2%	n.a.
Iran	0.8	2.1%	8.7	0.6%	n.a.
Saudi Arabia	0.7	1.8%	20.4	1.4%	n.a.
South Korea	0.6	1.5%	11.3	-1.2%	n.a.
Germany	0.6	1.5%	6.8	-3.9%	n.a.
Canada	0.5	1.4%	1.2	-2.5%	n.a.
Turkey	0.5	1.3%	5.9	5.1%	n.a.
Brazil	0.5	1.2%		-0.5%	n.a.
Mexico	0.5	1.2%	3.5	0.3%	n.a.
South Africa	0.4	1.1%	6.9	0.5%	n.a.
Australia	0.4	1.0%	14.5	0.4%	n.a.
Viet Nam	0.4	1.0%	3.7	6.5%	n.a.
United Kingdom	0.3	0.8%	4.5	1.4%	n.a.
Italy	0.3	0.8%	5.1	-3.6%	n.a.
International Aviation	0.6	1.5%	n.a.	13.2%	+6.8%
International Shipping	0.6	1.6%	n.a.	7.0%	0%

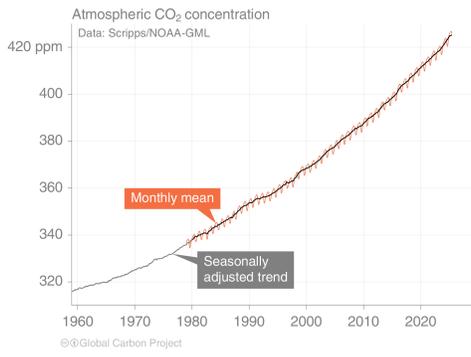
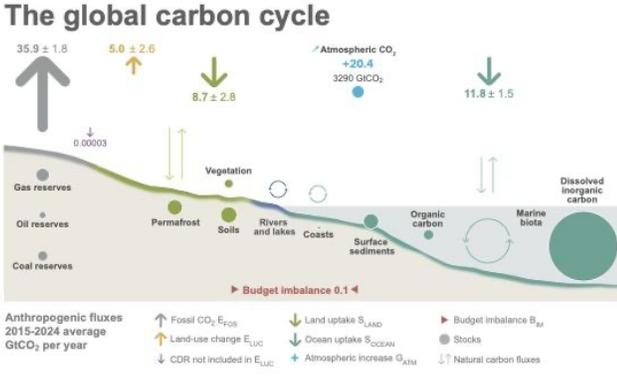
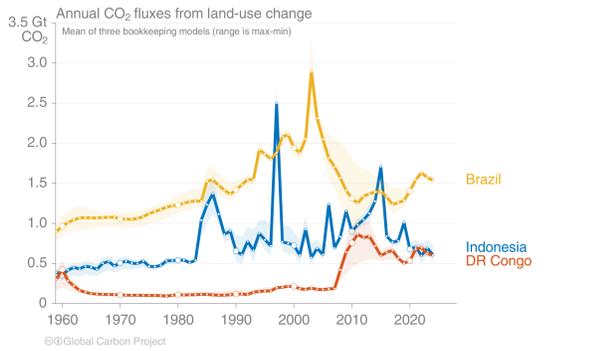
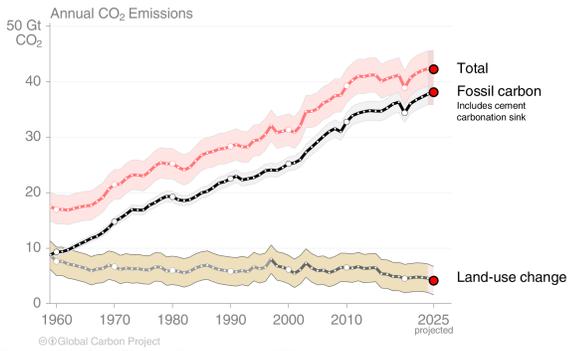
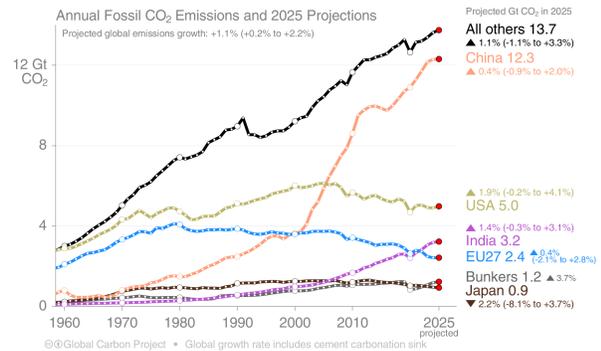
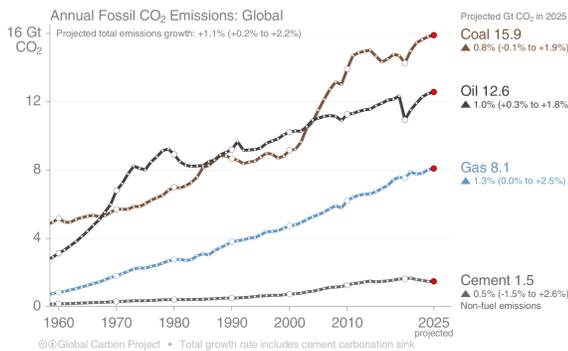
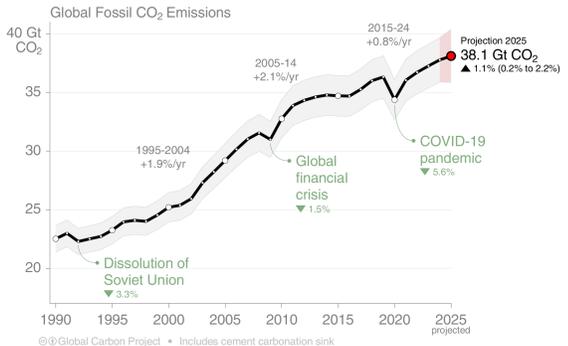
**Table 3. Decadal growth in fossil CO<sub>2</sub> emissions (percent per year).** World values include cement carbonation and IAS.

Decade	World	China	USA	India	EU27	OECD	Non-OECD	IAS	Rest of the World
<b>2005-2014</b>	2.1%	6.7%	-1.4%	6.4%	-2.2%	-1.0%	4.6%	1.9%	1.8%
<b>2015-2024</b>	0.8%	2.5%	-1.2%	3.6%	-2.5%	-1.5%	2.1%	-1.4%	0.6%

**Table 4. Land-use change CO<sub>2</sub> emissions from top 10 countries, in billion tonnes CO<sub>2</sub>/yr. Average over the 2015-2024 period.**

<b>Country</b>	<b>Net Emissions (billion tonnes CO<sub>2</sub>/yr)</b>	<b>% of global</b>
<b>World</b>	5.03	100%
Brazil	1.42	28.3%
Indonesia	0.84	16.7%
Democratic Republic of the Congo	0.61	12.2%
Russia	0.35	7.0%
Canada	0.12	2.5%
Côte d'Ivoire	0.12	2.4%
Viet Nam	0.12	2.3%
Myanmar	0.10	2.0%
Malaysia	0.09	1.8%
Angola	0.09	1.7%

# Key figures:



This media release is part of the Global Carbon Budget 2025, the annual update by the Global Carbon Project. The Global Carbon Budget publication builds on established methodologies in a fully transparent manner. The 2025 edition is undergoing peer-review in the journal *Earth System Science Data*.

Friedlingstein et al. (2025) Global Carbon Budget 2025. *Earth System Science Data*.

<https://essd.copernicus.org/preprints/essd-2025-XXX> Preprint under review accessible on 13 November 2025 at 00:01 (London time), see below for access prior to the embargo.

Nature publication: Friedlingstein et al. (2025) Emerging climate impact on carbon sinks in a consolidated carbon budget. <https://www.nature.com/articles/s41586-025-09802-5>

Accelerated Article Preview (AAP) published on 12 November 2025 at 16:00 (London time).

**DATA AVAILABILITY:** All material, publications, data, figures (including by country), are available under embargo on the following link:

[https://drive.google.com/drive/folders/1leL34aF-U-JOfgkGcOXgm4tKzyz2FK5Y?usp=drive\\_link](https://drive.google.com/drive/folders/1leL34aF-U-JOfgkGcOXgm4tKzyz2FK5Y?usp=drive_link)

Global Carbon Atlas <https://staging.globalcarbonatlas.org/budgets/carbon-budget>

#### **PRESS BRIEFINGS:**

- **UK:** Tuesday 11 November, 10:00 GMT. **Science Media Centre** online news briefings. Contact: [smc@sciencemediacentre.org](mailto:smc@sciencemediacentre.org)
- **Germany:** Tuesday 11 November, 12:30 CET (11:30 GMT). Science Media Centre online press briefing. Contact: [redaktion@sciencemediacenter.de](mailto:redaktion@sciencemediacenter.de)
- **Spain:** Tuesday 11 November. 10:00 CET. Spanish Science Media Center. Contact: [laura.chaparro@fecyt.es](mailto:laura.chaparro@fecyt.es)
- **France:** Wednesday 12 November, 12:00 CET (11:00 GMT). Contact: [florence.bardin@agencef.com](mailto:florence.bardin@agencef.com)
- **Australia:** Wednesday 12 November: 10:30 a.m. Australia, Sydney (00:30 CET). Australian Science Media Center: AusSMC [Info@smc.org.au](mailto:Info@smc.org.au)

#### **EVENTS AT COP 30:**

- University of Exeter: Launch of the Global Carbon Budget 2025: UNFCCC press conference at COP30 in Belém, Brazil. Location: Press Conference 2, Area D. Date & time: 13 November 2025, 10:00-10:30 (Brasilia time) / 13:00-13:30 (GMT).
- Climate Science: 2025 Global Carbon Budget and The Global South: Professor Stephen Sitch and Dr Thaís Rosan will present the findings of the 2025 Global Carbon Budget. Location: Coalition for Rainforest Nations Pavilion at COP30. Date & time: 13 November 2025, 14:15-15:00 (Brasilia time) / 17:15-18:00 (GMT). The University of Exeter is a partner of the [Coalition for Rainforest Nations Pavilion](#).

- GCB 2025. Latest trends in CO<sub>2</sub> emissions and sinks. Ramifications for the state of the planet and climate goals, Location: Planetary Science Pavilion. Date & time: 13 November 16:30-18:00h (Brasilia time) / 19:30-21:00 (GMT).

Contact: [pressoffice@exeter.ac.uk](mailto:pressoffice@exeter.ac.uk)

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