

Global Carbon Project

Briefing on key messages Global Carbon Budget 2022

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Important notice: this document is intended as background briefing for the co-authors and journalists covering the release of the Global Carbon Budget 2022. **Do not cite or quote until the embargo is lifted.**

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 2022 is the 17th edition of the annual update that started in 2006, and the 11th edition made available as a living data collection in the journal *Earth System Science Data*.

Data and methods are detailed in the publications, with links provided at the end of this document.

A. Headline: No sign of decrease in global CO₂ emissions

- Total CO₂ emissions remain high at a projected 40.6 billion tonnes of CO₂ (GtCO₂) in 2022, with no sign of the decrease that is urgently needed to tackle climate change. If current emissions levels persist, there is a 50% chance that warming of 1.5°C will be exceeded in 9 years.
- Global fossil CO₂ emissions are projected to rise 1.0% in 2022 (range 0.1% to 1.9%) led by growth in oil use, reaching* 36.6 GtCO₂. Projected 2022 emissions decrease in China and in the European Union, but increase in the United States, India, and the Rest of the World.
- Global CO₂ emissions from land-use change (LUC) are projected to be 3.9 GtCO₂ in 2022, following a small but uncertain decline over the past two decades. Indonesia, Brazil and the Democratic Republic of the Congo contribute 58% of global LUC emissions.
- Atmospheric CO₂ level is projected to average 417.2 ppm in 2022, 51% above pre-industrial levels. The land and ocean CO₂ sinks continue to take up around half of the CO₂ emissions, despite the negative impact of climate change.

B. CO₂ emissions

Preliminary data for 2022 show an increase in fossil CO₂ emissions relative to 2021 of +1.0% (range 0.1% to 1.9%) globally, primarily driven by growth in oil use from the delayed rebound of aviation since the COVID-19 pandemic.

- **The projected growth brings global fossil CO₂ emissions slightly above the 2019 pre-COVID-19 levels.**
 - 2020 emissions declined 5.4% from 2019 levels because of COVID-19 measures.
 - 2021 emissions rebounded 5.1% from 2020 levels.

* This estimate includes the cement carbonation sink of 0.8 GtCO₂ per year

- 2022 emissions are projected to increase 1.0% (range 0.1% to 1.9%) to 36.6 GtCO₂ based on preliminary data, slightly above the 2019 level of 36.3 GtCO₂.
- The latest data confirm that the rate of increase in fossil CO₂ emissions has slowed, from 3% per year during the 2000s to about +0.5% per year in the past decade.
- **Projected 2022 emissions from coal and oil are above their 2021 levels, with oil contributing most to total emissions growth** (see Table 1).
 - Coal emissions (41% of global emissions) are projected to rise 1.0% (range 0.2 to 1.8%), with rises in India, the European Union, and the Rest of the World, partly compensated by a drop in the USA and China.
 - Oil emissions (33% of global emissions) are projected to rise 2.2% (range 1.1 to 3.3%), and dominate the global rise in fossil CO₂ emissions. The projected growth in oil emissions is primarily driven by the delayed rebound of aviation since the COVID-19 pandemic. Rises in oil emissions are projected in all large regions except China, with the largest contributions from the Rest of the World (which includes international aviation), India, and the USA, and a smaller contribution from the European Union, partly compensated by a decrease in China.
 - Emissions from natural gas (22% of global emissions) are projected to decline 0.2% (range -1.1 to 0.7%), with a strong decrease in the European Union and smaller decreases elsewhere, partly compensated by a rise in the USA.
 - Cement emissions (5% of global emissions) are projected to decrease 1.6% (range -3.7% to +0.5%), with a strong decrease in China partly compensated by rises in India and the Rest of the World.
- **Projected 2022 emissions decrease in China and in the European Union, but increase in the United States, India, and the Rest of the World** (see Tables 1 & 2).
 - In China (32% of global emissions), emissions in 2022 are projected to decrease by 0.9% (range -2.3% to +0.4%). Continued lockdowns have constrained activity and economic growth, with emissions projected to rise by 0.1% for coal and decline 2.8% for oil, 1.1% for natural gas, and 7.0% for cement. The largest contribution to the total emissions decrease comes from the drop in cement emissions resulting from the important slowdown in property development.
 - In the United States (14% of global emissions), emissions in 2022 are projected to increase by 1.5% (range -1.0% to +4.0%). Emissions from natural gas are projected to rise by 4.7% and those from coal to decline by 4.6%. Emissions from consumption of oil products are projected to increase by 2%, largely because of the continued rebound of domestic aviation since the COVID-19 pandemic.
 - In the European Union (EU27, 8% of global emissions), emissions in 2022 are projected to decrease by 0.8% (range -2.8% to +1.2%), driven largely by the reduced supply of natural gas, with demand projected to be down by about 10% for the year. Emissions from coal are projected to increase by 6.7%, less than the drop in natural gas emissions, and emissions from oil to increase 0.9%.
 - In India (8% of global emissions), emissions in 2022 are projected to increase by 6.0% (range 3.9% to 8.0%), driven mostly by a 5% increase in coal emissions. Emissions from oil are up sharply, with a projected rise of 10%, but this returns them to about the 2019 levels. Emissions from natural gas are projected to decline 4% but contribute little to the total change as gas is a small part of the energy mix in India.
 - In the rest of the world (including international aviation and shipping, 42% of global emissions), emissions in 2022 are projected to increase by 1.7% (range 0.1% to 3.3%). Projections are for a rise of 1.6% for coal, 3.1% for oil, and 3% for cement, but a decline of 0.1% for natural gas. The growth in oil emissions can be largely

explained by the delayed rebound of international aviation from the COVID-19 pandemic restrictions.

- **Fossil CO₂ emissions decreased in 24 countries during the decade 2012-2021** while their economies grew. Altogether, these 24 countries contribute about one quarter of world CO₂ fossil emissions. Consumption-based emissions also fell significantly in 15 of these countries during the final decade for which estimates are available (2011-2020).

CO₂ emissions from land-use change (LUC) are projected to be 3.9 GtCO₂ in 2022, ten times less than fossil emissions, with a small but uncertain decline over the past two decades (see Table 3).

- Emissions from deforestation, the main driver of global LUC emissions, remain high at 6.7 GtCO₂ per year over the 2012-2021 period. Emissions from peat drainage and peat fire made an additional smaller contribution (0.8 GtCO₂ per year over the same period).
- Removals through re-/afforestation and wood harvest of 3.5 GtCO₂ per year counterbalance half of the deforestation emissions.
- Global net CO₂ emissions from land-use change², the difference between gross emissions and removals, averaged 4.5 GtCO₂ per year for the 2012-2021 period with a preliminary projection for 2022 of 3.9 ± 2.6 GtCO₂.
- Global net LUC CO₂ emissions show a small but uncertain decline over the past two decades, driven in particular by growing removals. Because of large uncertainty, the decreasing trend is yet to be confirmed.
- The highest net CO₂ emissions from land-use change during 2012-2021 are Indonesia and Brazil, which together with the Democratic Republic of the Congo contribute more than half (58%) of the global total land-use emissions.

Total CO₂ emissions from fossil and land-use change combined have remained high but are approximately constant since 2015.

- Total anthropogenic CO₂ emissions* are projected to reach 40.6 GtCO₂ in 2022, slightly above their 2021 level of 40.2 GtCO₂ but still below the 2019 level of 40.9 GtCO₂. Total CO₂ emissions have been approximately flat since 2015, with the increase in fossil CO₂ emissions offset by the decrease in land-use change CO₂ emissions. Uncertainty on the total and trend in total CO₂ emissions is higher than fossil CO₂ emissions, because of the large and persistent uncertainty in land-use change emissions.
- The remaining carbon budget for a 50% likelihood to limit global warming to 1.5°C, 1.7°C and 2°C has respectively reduced to 380 GtCO₂ (9 years at 2022 emissions levels), 730 GtCO₂ (18 years) and 1230 GtCO₂ (30 years).
- Reaching zero CO₂ emissions by 2050 entails a total anthropogenic CO₂ emissions linear decrease by about 1.4 GtCO₂ each year, comparable to the observed fall in 2020 emissions resulting from COVID-19 measures, highlighting the scale of the action needed. This would result in additional emissions of 560 GtCO₂ from year 2023, leading to a 50% likelihood to limit warming around 1.6°C.

C. Atmospheric CO₂ accumulation and the natural carbon sinks

* These estimates include the cement carbonation sink of 0.8 GtCO₂ per year

The level of CO₂ continued to increase in the atmosphere because of continued CO₂ emissions.

- Atmospheric CO₂ concentration increased 2.5 parts per million in 2021 and is projected to increase by 2.5 parts per million (19.5 GtCO₂) in 2022 to reach 417.2 parts per million averaged over the year ([see latest trends here](#)), 51% above its pre-industrial level.

The land and ocean CO₂ sinks combined continued to take up around half (53% over the past decade) of the CO₂ emitted to the atmosphere, despite the negative impact of climate change.

- The ocean CO₂ sink resumed a more rapid growth in the past two decades after low or no growth during the 1991-2002 period. The ocean CO₂ sink was 10.5 GtCO₂ per year during the decade 2012-2021 (26% of total CO₂ emissions), with a similar preliminary estimate of 10.5 GtCO₂ for 2022.
- The land CO₂ sink continued to increase during the 2012-2021 period primarily in response to increased atmospheric CO₂, albeit with large interannual variability. The land CO₂ sink was 11.4 GtCO₂ per year during the 2012-2021 decade (29% of total CO₂ emissions), 1.4 GtCO₂ per year larger than during the 2000s, with a preliminary 2022 estimate of around 12.4 GtCO₂.
- Climate change reduced the uptake of CO₂ by the ocean and land sinks by an estimated 4% and 17%, respectively, over the 2012-2021 decade.

Table 1. Projected change in fossil CO₂ emissions by fuel type in million tonnes CO₂ (percent in parenthesis) for 2022 compared to 2021. IAS stands for International aviation and shipping.

Country	Total	Coal	Oil	Natural gas	Cement
World (incl. IAS)	+364 (+1.0%)	+153 (+1.0%)	+258 (+2.2%)	-19 (-0.2%)	-27 (-1.6%)
China	-108 (-0.9%)	+8 (+0.1%)	-48 (-2.8%)	-8.5 (-1.1%)	-60 (-7.0%)
USA	+76 (+1.5%)	-46 (-4.6%)	+44 (+2%)	+77 (+4.7%)	+0.5 (+1.2%)
EU27	-22 (-0.8%)	+46 (+6.7%)	+10 (+0.9%)	-78 (-10%)	0 (0%)
India	+162 (+6%)	+90 (+5%)	+62 (+10%)	-5.3 (-4%)	+15 (+10%)
RoW (incl. IAS)	+256 (+1.7%)	+55 (+1.6%)	+189 (+3.1%)	-4 (-0.1%)	+17 (+3%)

Table 2. 2021 fossil CO₂ emissions from top 20 countries including the EU27 (together and separately) in billion tonnes CO₂/yr, and projection of growth for 2021. IAS stands for International aviation and shipping.

Country	2021 emissions (billion tonnes CO ₂ /yr)	2021 % of total (excl. IAS)	2021 emissions per capita (tonnes CO ₂ /pers/yr)	2021 growth (percent)	2022 projected growth (percent)
China	11.5	31.6%	8.0	5.0%	-0.9% (-2.3% to +0.4%)
USA	5.0	13.8%	14.9	6.5%	+1.5% (-1% to +4%)

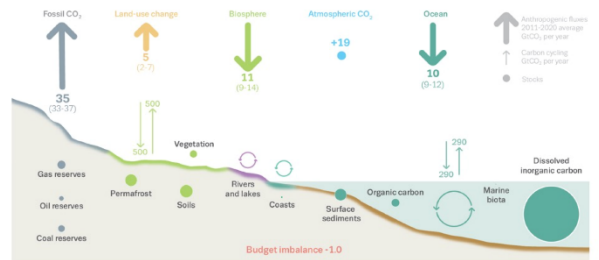
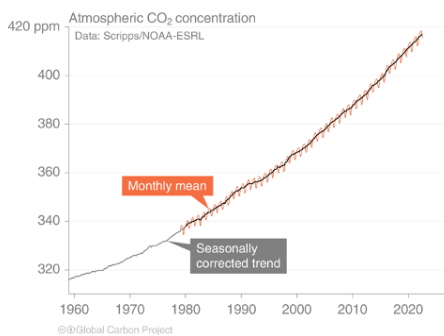
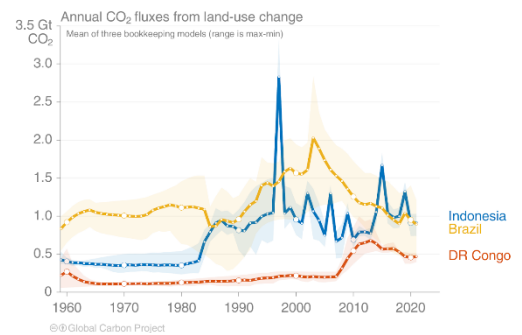
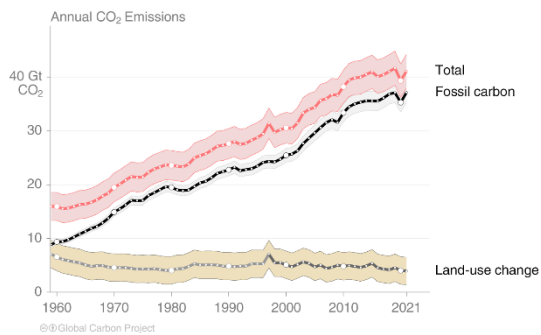
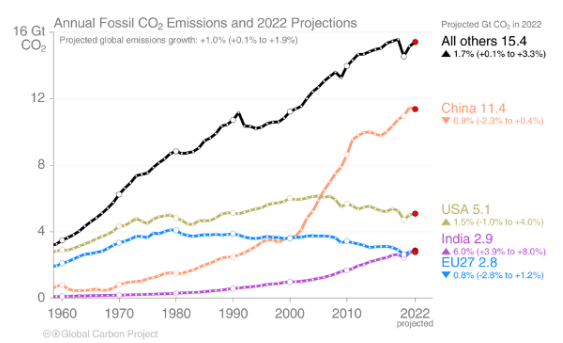
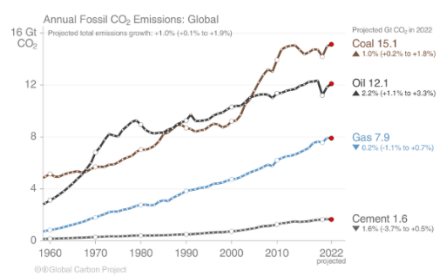
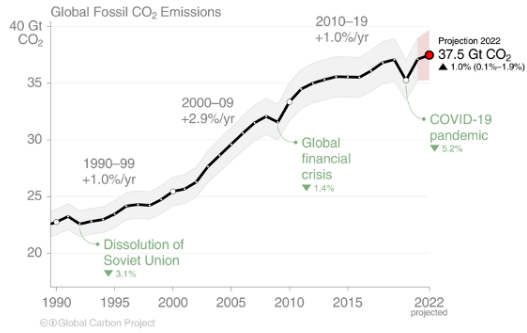
EU27	2.8	7.7%	6.3	6.8%	-0.8%	(-2.8% to +1.2%)
India	2.7	7.5%	1.9	11.1%	+6.0%	(+3.9% to +8%)
Russia	1.8	4.7%	12.1	8.4%		
Japan	1.1	2.9%	8.6	2.7%		
Iran	0.75	2.0%	8.5	2.9%		
Germany	0.67	1.8%	8.1	5.8%		
Saudi Arabia	0.67	1.8%	18.7	2.0%		
Indonesia	0.62	1.7%	2.3	1.8%		
South Korea	0.62	1.7%	11.9	3.4%		
Canada	0.55	1.5%	14.3	2.3%		
Brazil	0.49	1.3%	2.3	10.8%		
Turkey	0.45	1.2%	5.3	8.2%		
South Africa	0.44	1.2%	7.3	0.3%		
Mexico	0.41	1.1%	3.2	4.2%		
Australia	0.39	1.1%	15.1	-1.9%		
United Kingdom	0.35	0.9%	5.2	6.6%		
Italy	0.33	0.9%	5.5	9.0%		
Poland	0.33	0.9%	8.6	8.6%		
Viet Nam	0.33	0.9%	3.3	-0.6%		
World (incl. bunkers)*	37.12	100%	4.7	5.6%		(+0.1% to +1.0% to +1.9%)

Table 3. Land-use changes CO₂ emissions from key countries, in billion tonnes CO₂/yr. Average over the 2012-2021 period.

	Emissions (billion tonnes CO ₂ /yr)	% of global
Indonesia	1.05	23.1%
Brazil	1.03	22.7%
Democratic Republic of the Congo	0.56	12.4%
Tanzania	0.15	3.3%
Malaysia	0.13	2.8%
Myanmar	0.12	2.7%
Angola	0.11	2.5%
Viet Nam	0.11	2.5%
World	4.54	100%

Key figures:

* This estimate does not include the cement carbonation sink of 0.8 GtCO₂ per year



This media release is part of the Global Carbon Budget 2022, the annual update by the Global Carbon Project. The Global Carbon Budget annual update builds on established methodologies in a fully transparent manner. The 2022 edition has been peer-reviewed prior to publication in the journal *Earth System Science Data*.

Friedlingstein et al. (2022) Global Carbon Budget 2022. *Earth System Science Data*.

<https://doi.org/10.5194/essd-14-4811-2022> (see below for access prior to the embargo)

DATA AVAILABILITY:

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

<https://drive.google.com/drive/u/0/folders/1JLOukEVVYQsiuCma5hRN7L0iXiZ5vW0F>

PRESS BRIEFINGS:

Science Media Centre online news briefings will be held as follows:

UK: Tuesday 8 November, 11:00 GMT. Contact: tom@sciencemediacentre.org

Germany: Tuesday 8 November, 14:00 CET. Contact: info@sciencemediacenter.de

Spain: Tuesday 8 November, 10:00 CET. Contact: info@sciencemediacentre.es

Australia: Wednesday 9 November, 10:00 AEDT. Contact: info@smc.org.au

EVENTS AT COP 27:

UN Press Conference & launch of Global Carbon Budget 2022. Friday 11 November, 09:00 Egypt time (07:00 GMT) Press Conference Room, Luxor Taba Area, COP27

2022 GCP Carbon Budget, Scaling Solutions and the Role of Agriculture. Friday 11 November, 16:45 Egypt time (14:45 GMT) Room Osiris, COP27

Global Carbon Budget 2022: Results & Implications for Rainforest Nations & the Paris Agreement. Saturday 12 November, 11:00 Egypt time (09:00 GMT), Coalition for Rainforest Nations (CfRN) Pavilion, COP27

Global Carbon Budget 2022: Announcement Session at the World Climate Summit. Sunday 13 November, 16:00 Egypt time (14:00 GMT), Park Regency, Sharm El-Sheikh, COP27

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