

Important Scientific Studies on the Limit of Atmospheric CO₂ Required to Protect Human Rights

The Paris temperature targets of 1.5°C and 2.0°C are often portrayed as the “best available science” and “protective of human rights”. The targets are neither. An overwhelming body of scientific research—including numerous conclusions from the Intergovernmental Panel on Climate Change (IPCC)—conclude that **1.5°C of warming poses significant risks for natural and human systems and will result in grave human rights violations**. In turn, the Paris temperature targets should not serve as a meaningful benchmark for protecting human rights. Instead, and looking back at the original objective of the UN Framework Convention on Climate Change, **States should urgently aim to reduce the concentration of greenhouse gases—especially CO₂—in the atmosphere to prevent dangerous anthropogenic interference with the climate system**.

This bibliography provides a synopsis and links to **important scientific studies dating back to 2008** that provide research findings and conclusions on the Earth’s atmospheric greenhouse gas boundary. These studies address why the annual mean concentration of CO₂ in Earth’s atmosphere must fall from current levels of ~420 parts per million (ppm) (a level currently resulting in ~1.1°C to 1.3°C of warming above pre-industrial levels) to below 350 ppm as soon as possible and no later than 2100 to reverse climate change and avoid further exacerbating violations of human rights. **This ceiling is known as the 350 ppm limit**. Additionally, the studies discuss the dangers of remaining above the 350 ppm limit, and the associated risks of reaching and remaining at the Paris temperature target of 1.5°C of warming above pre-industrial levels.

Benjamin W. Abbott and 12 Others, Accelerating the Renewable Energy Revolution to Get Back to the Holocene, 11:9 Earth’s Future 1 (2023)

Link: <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2023EF003639>

Synopsis: This scientific article explains that the UN’s Paris Agreement goal of keeping global warming between 1.5°C and 2.0°C is dangerously obsolete, will result in hundreds of millions of pollution deaths, is poised to trigger multiple tipping elements in the Earth system, and imposes an immense burden on young people and future generations. The article further explores ways to avoid these harms via rapid defossilization and climate restoration efforts that are both technically feasible and economically viable.

Katherine Richardson and 28 Others, Earth Beyond Six of Nine Planetary Boundaries, 9:37 Science Advances 1 (2023)

Link: <https://www.science.org/doi/10.1126/sciadv.adh2458>

Synopsis: This research reinforces that: i) greenhouse gas emissions are one of the most important drivers of anthropogenic impacts on Earth's energy budget; ii) the planetary boundary for atmospheric CO₂ concentration is 350 ppm; iii) human activities brought the climate system outside of its safe operating space around 1988; and iv) today's level of atmospheric CO₂ concentration places Earth even further outside the safe operating space. The research suggests the possibility of extreme Earth system impacts even at 1.5°C warming, with risks already markedly increasing above 1.0°C of warming.

Johan Rockström and 50 Others, Safe and Just Earth System Boundaries, 619 Nature 102 (2023)

Link: <https://www.nature.com/articles/s41586-023-06083-8>

Synopsis: This study proposes various Earth system boundaries for maintaining the resilience and stability of the Earth system and minimizing exposure to significant harm to humans from Earth system change. The study determines that the just boundary for avoiding significant harm to tens of millions of people should be set at or below 1.0°C of average surface temperature increase above pre-industrial levels, which is only achieved through keeping atmospheric CO₂ below 350 ppm.

Nico Wunderling and 7 Others, Global Warming Overshoots Increase Risks of Climate Tipping Cascades in a Network Model, 13 Nature Climate Change 75 (2022)

Link: <https://www.nature.com/articles/s41558-022-01545-9>

Synopsis: This study looks at a range of temperature overshoot scenarios using a stylized network model of four interacting climate tipping elements to investigate the danger of crossing tipping-point thresholds and the high likelihood of crossing these thresholds under current policies and actions. It also identifies a high climate-risk zone at or above 1.5°C and explains that to avoid tipping events final convergence temperatures must fall substantially below 1.5°C in the long run with safe levels found only at global temperatures lower than the current levels.

David Armstrong McKay and 9 Others, Exceeding 1.5°C Global Warming Could Trigger Multiple Climate Tipping Points, 377:6611 Science 1 (2022)

Link: <https://www.science.org/doi/10.1126/science.abn7950>

Synopsis: This scientific article identifies a series of irreversible climate tipping points in Earth's climate system that are increasingly likely to be triggered as global average surface temperature increases to 1.5°C or 2.0°C above pre-industrial levels, leading to dramatic and difficult to predict consequences for all other regions of the world. Avoiding such tipping points, or a safe climate system, is only possible by maintaining a climate with a global mean temperature less than 1.0°C.

Will Steffen and 17 Others, Planetary Boundaries: Guiding Human Development on a Changing Planet, 347:6223 Science 736 (2015)

Link: <https://www.science.org/doi/10.1126/science.1259855>

Synopsis: This article updates the planetary boundary framework to identify levels of anthropogenic perturbations below which the risk of destabilization of the Earth System is likely to remain low. Based on analysis of several human factors affecting Earth System functioning, the article narrows the planetary boundary to 350 to 450 ppm, with climate risks increasing above 350 ppm, and cautions against moving too far away from a Holocene-like state. It finds that the upper limit for a safe climate is atmospheric CO₂ <350 ppm.

James Hansen and 17 Others, Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature, 8:12 PLOS ONE 1 (2013)

Link: <https://doi.org/10.1371/journal.pone.0081648>

Synopsis: This scientific article analyzes different sets of climate data to conclude that society should reassess what constitutes a "dangerous level" of global warming. It uses the atmospheric CO₂ limit of <350ppm to determine the magnitude of emission reduction needed to stabilize the climate system and avoid potentially disastrous impacts on young people, future generations, and nature.

Johan Rockström and 28 Others, A Safe Operating Space for Humanity, 461 Nature 472 (2009)

Link: <https://www.nature.com/articles/461472a>

Synopsis: This article identifies and proposes several planetary boundaries that, if transgressed, will increase the risk of irreversible climate change. It cautions that human changes to atmospheric CO₂ should not exceed 350 ppm by volume if human development is to continue.

James Hansen and 9 Others, Target Atmospheric CO₂: Where Should Humanity Aim?, 2 The Open Atmospheric Science Journal 217 (2008)

Link: <https://openatmosphericsciencejournal.com/contents/volumes/V2/TOASCJ-2-217/TOASCJ-2-217.pdf>

Synopsis: This study uses paleoclimate data to show that long-term climate has high sensitivity to climate forcings and that the global mean CO₂ of 385 ppm is in the dangerous zone. It further explains that an initial CO₂ target of 350 ppm is supported by the data and necessary to avoid irreversible catastrophic effects and maintain the climate to which humanity, wildlife, and the rest of the biosphere are adapted.

Further information about the best available climate science is available here ourchildrenstrust.org/the-science or reach out to info@ourchildrenstrust.org