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How much CO2 is a child? Updating the carbon legacy

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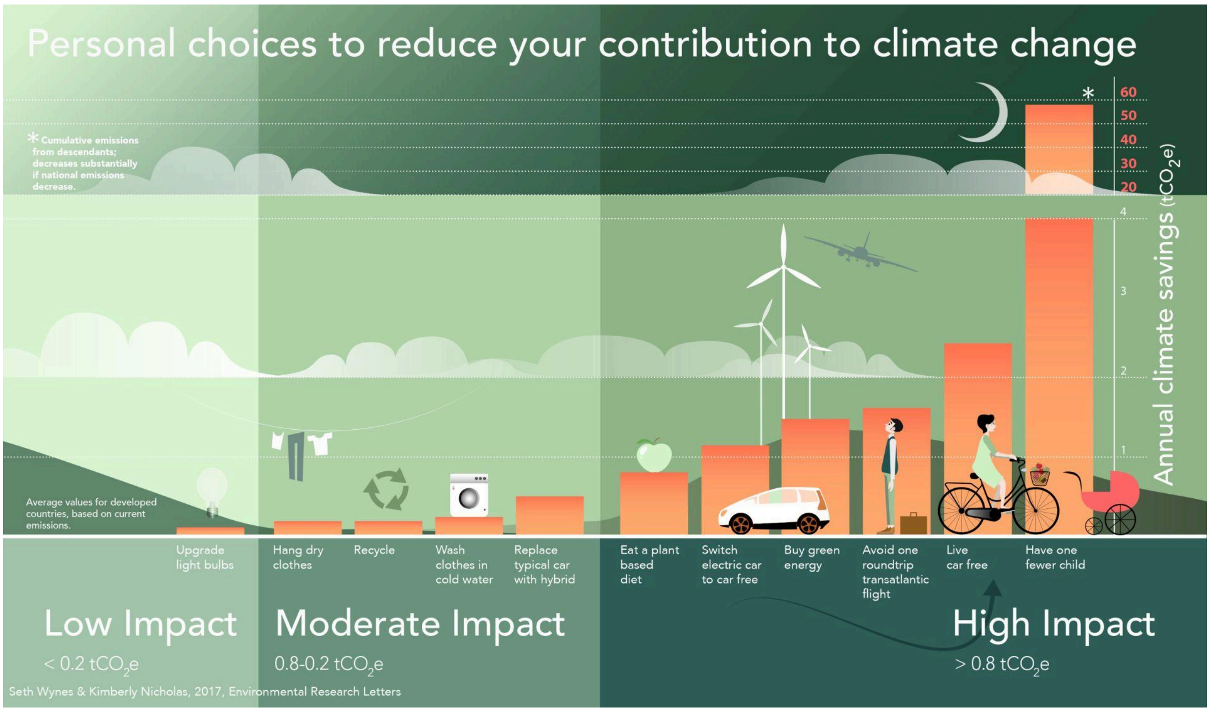
Abstract

Population growth is widely recognized as one of the main drivers of greenhouse gas emissions that cause climate change (Dhakal et al. 2022). However, the nature and evaluation of this link are controversial and debated (van Dalen & Henkens 2021, Muttarak 2022, Véron 2022). Of particular concern to individuals is the environmental impact of their own fertility choices (Schneider-Mayerson & Leong 2020). The figure of 60 tons of CO2 per child has been widely circulated (Wynes & Nicholas 2017), building on the so-called "carbon legacy" calculation (Murtaugh & Schlax 2009). This method has been heavily discussed, mostly from a philosophical perspective (Pedersen & Lam 2018, Pinkert & Sticker 2021), and suffers from several issues. In this study we present an alternative computation of the carbon legacy of a child in different countries using long-term SSP emission scenarios (Meinshausen et al. 2020), UN population prospects and a differentiated profile of emissions by age (Zagheni 2011). We combine this calculation with several possible formulas for philosophical responsibility, adding nuance to the original maximalist causal responsibility. We find that, in developed countries, the carbon legacy of a child is much smaller and comparable to other individual actions. It is even less for a "green child" or with more common philosophical representations of responsibility. We conclude that current household emissions and their future trajectories are of much higher importance than the choice to have one more child.

Introduction

Population growth is one of the main drivers of greenhouse gas emissions causing climate change, yet it is also one of the main knowledge gaps in emission drivers for the IPCC (Dhakal et al. 2022). The nature and evaluation of this link have been controversial for a long time (van Dalen & Henkens 2021, Muttarak 2022, Véron 2022). Whereas historically, the debate has mainly covered the population level, the individual side of personal fertility choices impact has come to the fore in recent years (Schneider-Mayerson & Leong 2020). There are reasons to believe this angle is replacing the population debate : ongoing demographic transition, human rights abuse, clear emissions inequality numbers (Chancel & Piketty 2015), strong focus on personal responsibility … In rich countries confronted to falling fertility, calling to personal responsibility seems the last acceptable way to ask for population reduction.

Having a child has been presented in mainstream media (e.g. Carrington 2017) as the worst thing to do against the climate, using numbers from Wynes & Nicholas (2017). In this article, the authors computed the contribution of an additional child to 60 tons of CO2 per year, dwarfing all other personal actions:



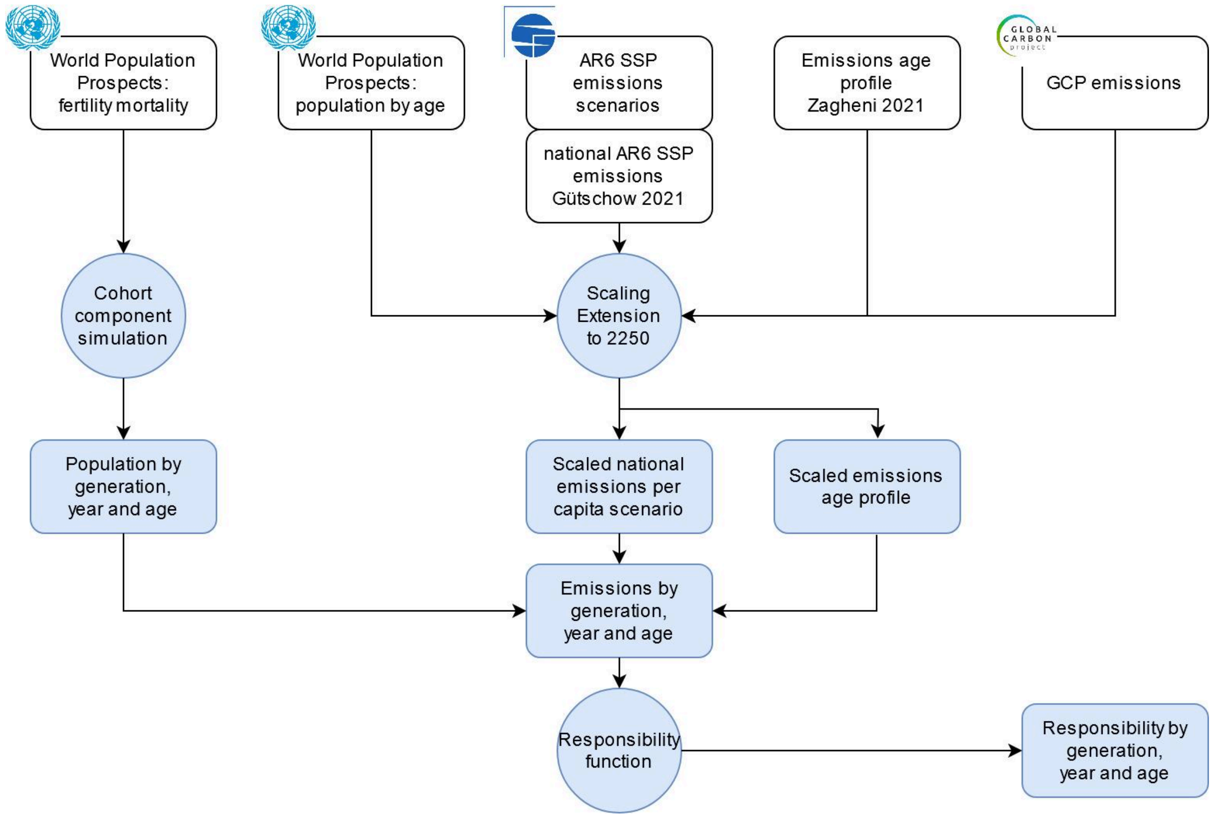
Impact of personal choices (Wynes & Nicholas 2017, faq)

Their source for the figure is the calculation by Murtaugh & Schlax (2009), called “carbon legacy,” who conclude that the summed emissions of an average person’s descendants in the United States, weighted by their relatedness to him, amount to 9441 tons of CO2.

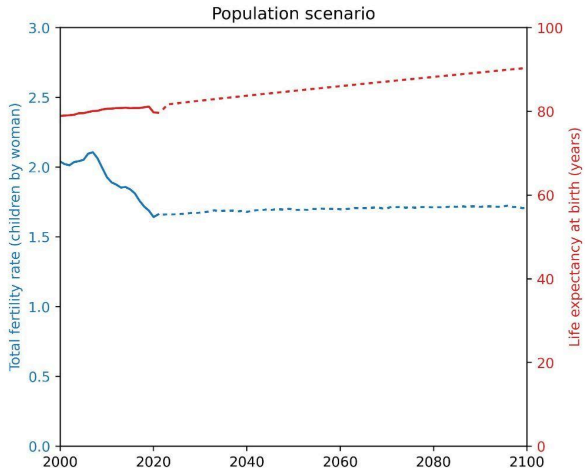
The significance of these numbers has been downplayed by Wynes and Nicholas in interviews (Lianne 2017, Nicholas 2021). Much of both the academic coverage and criticism have been from a philosophical perspective: policy implications (Hedberg 2020), responsibility double-counting (van Basshuysen and Brandstedt 2018), responsibility splitting (Pinkert & Sticker 2021) and comparison to consumption choices (Pedersen & Lam 2018).

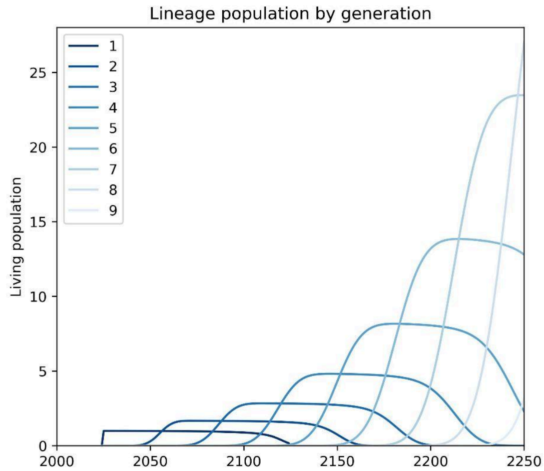
Several other issues can be raised with the calculation and its usage: medium and high emissions scenarios with constant/growing emissions per capita forever, demographic scenarios implying the extinction of humanity, calculation for one parent only, age profile, different usage of a total sum or yearly value … To our knowledge they have not been discussed in detail in the scientific lecture. In this paper we offer an updated carbon legacy calculation with different results depending on the question asked, its philosophical implications and the future emission and demographic trajectories for the child.

Data & methods

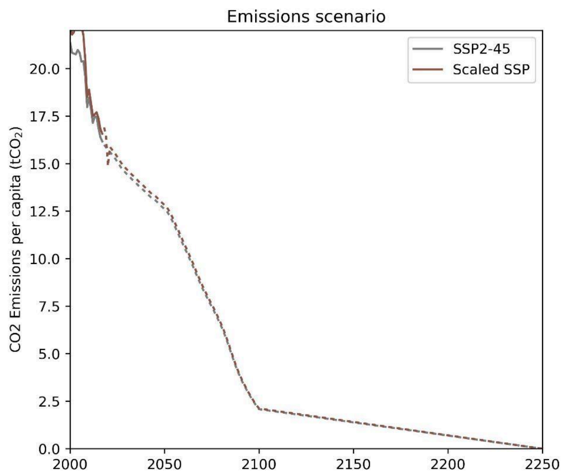


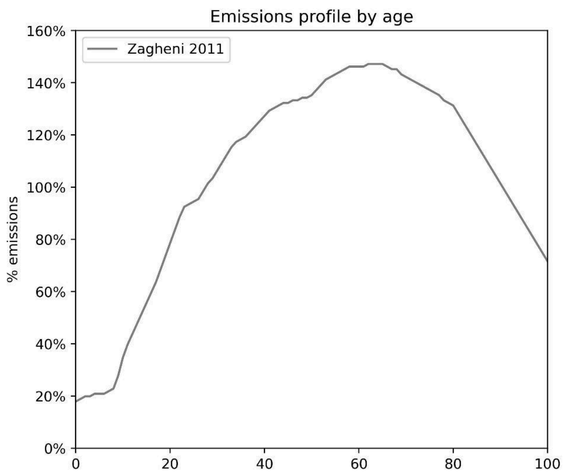
In a first step, we simulate detailed population data for a child born today and her offspring until 2250 with the cohort component methods. We use the UN projected fertility and mortality rates by age, and assume constant rates from 2100.





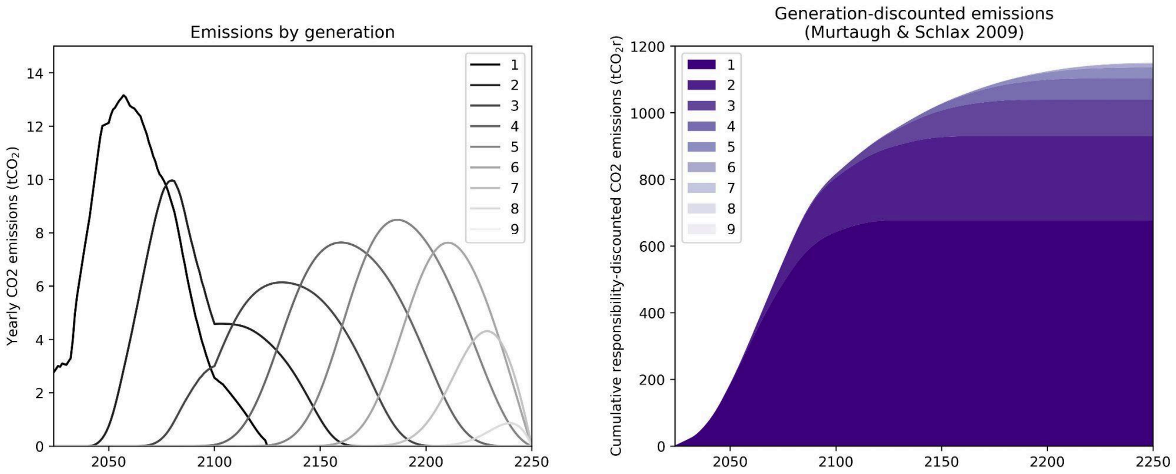
In a second step we compute the emissions per capita scenarios for country-level Shared Socioeconomic Pathways (SSP) emissions (Gütschow et al. 2021) and extend them after 2100 to 2250, when global emissions reach net zero in all scenarios (Meinshausen et al. 2020). We also normalize these scenarios to match consumption emissions from the Global Carbon Project (Friedlingstein et al. 2022) and an emissions profile by age (Zagheni 2011).





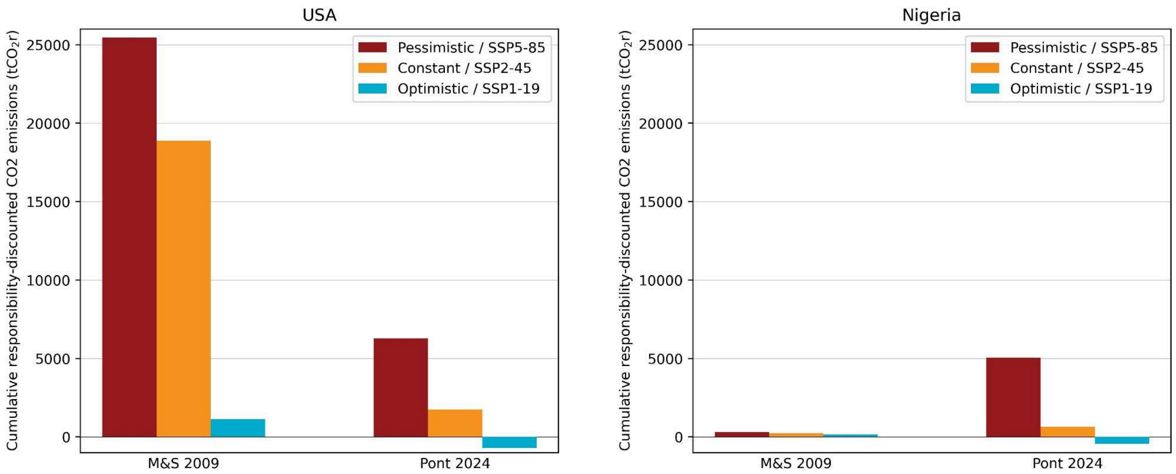
Finally we calculate the emissions by year, generation, age and distinguish several possible options for "responsibility" (starting from Pinkert & Sticker 2021), including:

- In the same spirit as Murtaugh and Schlax, the sum of all emissions for the lineage, representing a maximal causal responsibility. In this case, only CO2 emissions are counted and the total sum is presented.
- Yearly emissions figures to compare with usual figures from life cycle analysis;
- Degressive responsibility by generation to avoid double counting (van Basshuysen and Brandstedt 2018).
- Responsibility limited to the first years of the child before the majority.
- Responsibility limited to estimated necessary minimal emissions.

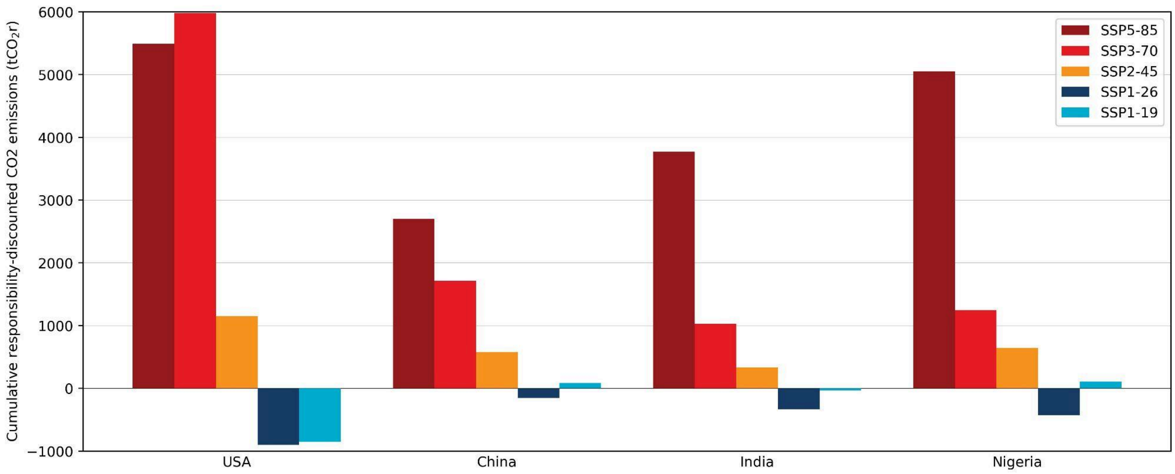


First results

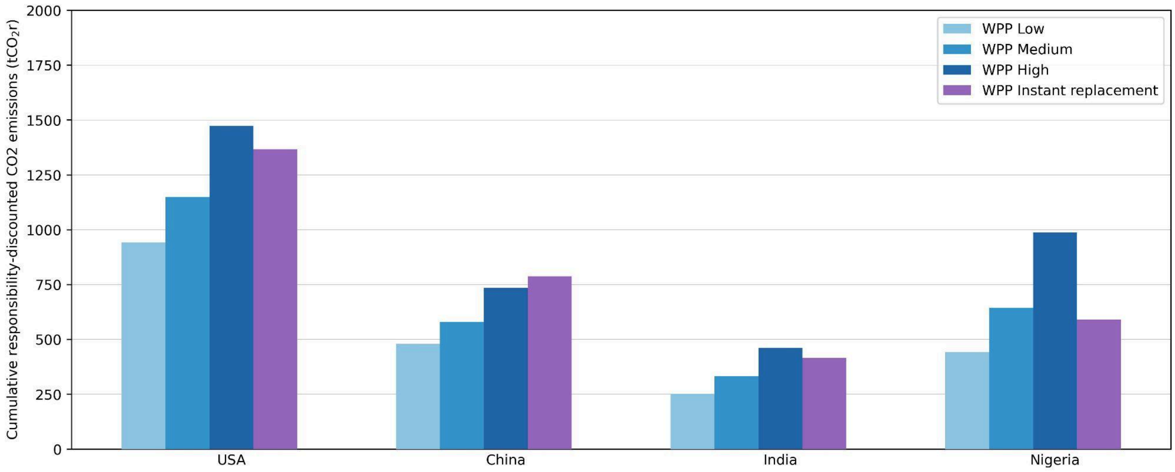
Our first results are significantly lower than Murtaugh & Schlax for developed countries, but higher for developing countries.



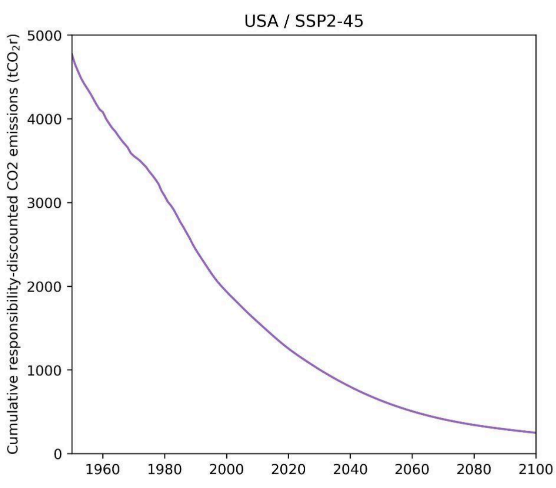
The main difference comes from the emissions scenario, where the "constant" scenario from Murtaugh & Schlax overestimates emissions compared to the SSP2-45. SSP scenarios make a significant difference for all countries, with the most optimistic scenarios resulting in a negative carbon legacy. Medium and high scenarios give similar magnitudes for all countries.

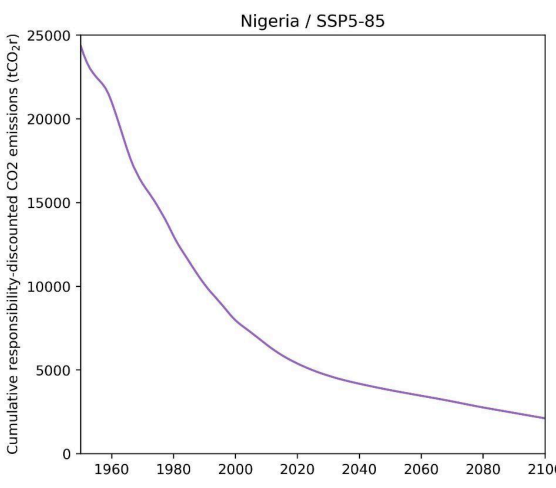


Demographic scenarios have a much smaller impact, even in developing countries with high fertility.

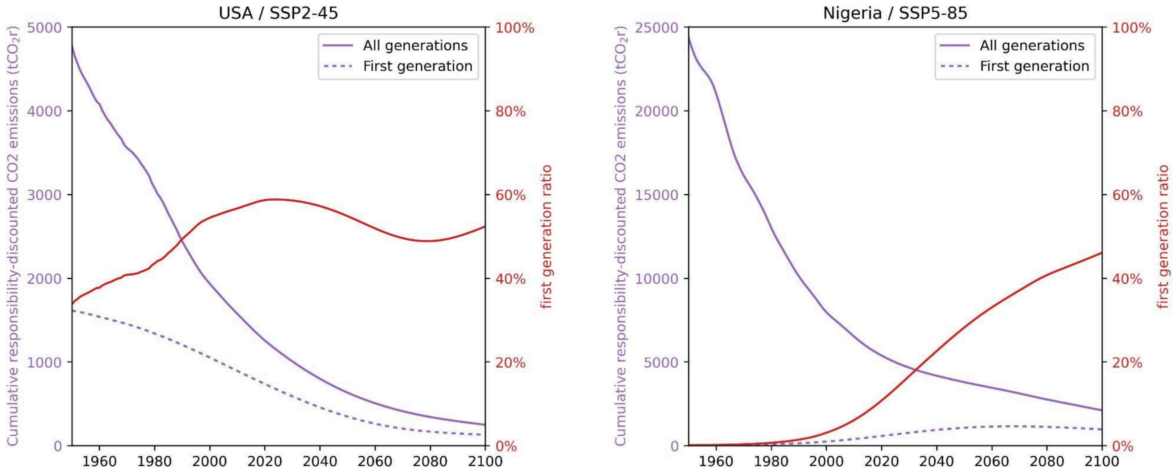


The carbon legacy declines by birth year, with a peak before 1950 in most countries. It stays true even in developing countries with the worst-case emissions scenario.

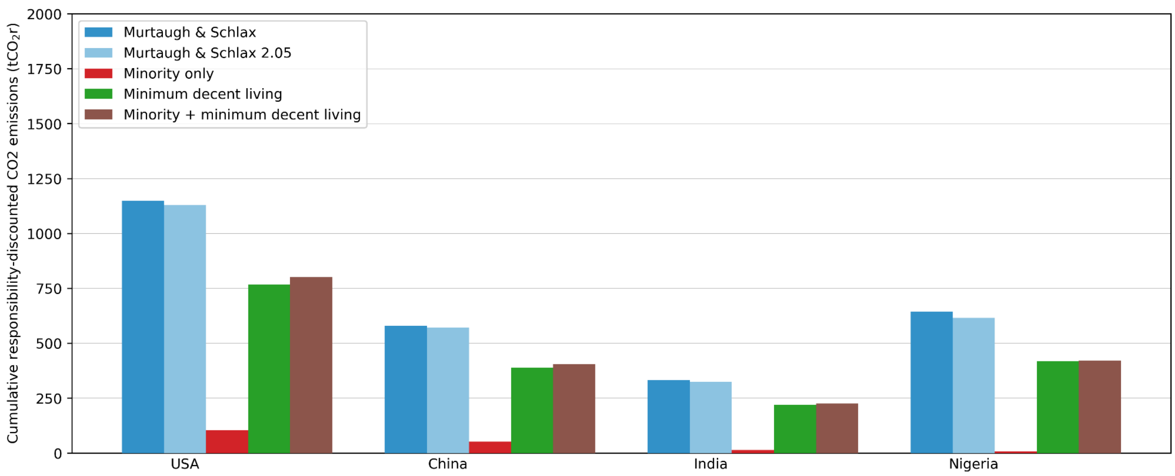




Distinguishing the first generation, its weight in the carbon legacy generally increases.



The carbon legacy is supposed to cover both impact and responsibility, and overcounts by generation. An emissions profile by age can be calculated statistically as the emissions a child would add to his parents household, giving a better vision of the climate impact of procreation than just average emissions. There are other possible ways to calculate responsibility, for example by counting only emissions before the majority or only consumption necessary for survival or for a decent living.



Perspectives

These results are preliminary and will require several significant works before publication, including:

- A separate men/women population projection
- IIASA WIC2023 projections
- Testing different population scenarios after 2100
- Calculating a detailed profile of marginal child emissions

- Calculating a detail profile of minimum decent living / green child scenarios
- Properly defining the different conceptions of causality and responsibility involved and analyze their impacts
- Evaluating the model uncertainties
- Exploring how we can use a similar approach to answer global questions

References

Carrington, Damian. 'Want to Fight Climate Change? Have Fewer Children'. *The Guardian*, 12 July 2017, sec. Environment. https://www.theguardian.com/environment/2017/jul/12/want-to-fight-climate-change-have-fewer-children.

Chancel, Lucas, and Thomas Piketty. 'Carbon and Inequality: From Kyoto to Paris Trends in the Global Inequality of Carbon Emissions (1998-2013) & Prospects for an Equitable Adaptation Fund World Inequality Lab', 2015.

Dalen, Hendrik P. van, and Kène Henkens. 'Population and Climate Change: Consensus and Dissensus among Demographers'. *European Journal of Population* 37, no. 3 (1 July 2021): 551–67. https://doi.org/10.1007/s10680-021-09580-6.

Dhakal, S., J.C. Minx, F.L. Toth, A. Abdel-Aziz, M.J. Figueroa Meza, K. Hubacek, I.G.C. Jonckheere, et al. 'Emissions Trends and Drivers'. Edited by P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, et al. *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, NY, USA: Cambridge University Press, 2022. https://doi.org/10.1017/9781009157926.004.

Friedlingstein, Pierre, Michael O'Sullivan, Matthew W. Jones, Robbie M. Andrew, Dorothee C. E. Bakker, Judith Hauck, Peter Landschützer, et al. 'Global Carbon Budget 2023'. *Earth System Science Data* 15, no. 12 (5 December 2023): 5301–69. https://doi.org/10.5194/essd-15-5301-2023.

Gütschow, Johannes, M. Louise Jeffery, Annika Günther, and Malte Meinshausen. 'Country-Resolved Combined Emission and Socio-Economic Pathways Based on the Representative Concentration Pathway (RCP) and Shared Socio-Economic Pathway (SSP) Scenarios'. *Earth System Science Data* 13, no. 3 (11 March 2021): 1005–40. https://doi.org/10.5194/essd-13-1005-2021.

Ivanova, Diana, John Barrett, Dominik Wiedenhofer, Biljana Macura, Max Callaghan, and Felix Creutzig. 'Quantifying the Potential for Climate Change Mitigation of Consumption Options'. *Environmental Research Letters* 15, no. 9 (August 2020): 093001. https://doi.org/10.1088/1748-9326/ab8589.

Meinshausen, Malte, Zebedee R. J. Nicholls, Jared Lewis, Matthew J. Gidden, Elisabeth Vogel, Mandy Freund, Urs Beyerle, et al. 'The Shared Socio-Economic Pathway (SSP) Greenhouse Gas Concentrations and Their Extensions to 2500'. *Geoscientific Model*

Development 13, no. 8 (13 August 2020): 3571–3605. https://doi.org/10.5194/gmd-13-3571-2020.

Murtaugh, Paul A., and Michael G. Schlax. 'Reproduction and the Carbon Legacies of Individuals'. *Global Environmental Change* 19, no. 1 (1 February 2009): 14–20. https://doi.org/10.1016/j.gloenvcha.2008.10.007.

Muttarak, Raya. 'Demographic Perspectives in Research on Global Environmental Change'. *Population Studies* 75, no. sup1 (15 December 2021): 77–104. https://doi.org/10.1080/00324728.2021.1988684.

Pedersen, Rebecca Laycock, and David P. M. Lam. 'Second Comment on "The Climate Mitigation Gap: Education and Government Recommendations Miss the Most Effective Individual Actions"'. *Environmental Research Letters* 13, no. 6 (July 2018): 068001. https://doi.org/10.1088/1748-9326/aac9d0.

Pinkert, Felix, and Martin Sticker. 'Procreation, Footprint and Responsibility for Climate Change'. *The Journal of Ethics* 25, no. 3 (2020): 293–321. https://doi.org/10.1007/s10892-020-09345-z.

Schneider-Mayerson, Matthew, and Kit Ling Leong. 'Eco-Reproductive Concerns in the Age of Climate Change'. *Climatic Change* 163, no. 2 (1 November 2020): 1007–23. https://doi.org/10.1007/s10584-020-02923-y.

United Nations. *World Population Prospects 2022: Summary of Results*. Statistical Papers - United Nations (Ser. A), Population and Vital Statistics Report. United Nations, 2022. https://doi.org/10.18356/9789210014380.

Véron, Jacques. 'Population and Environment Interactions: Macro Perspectives'. In *International Handbook of Population and Environment*, edited by Lori M. Hunter, Clark Gray, and Jacques Véron, 15–35. International Handbooks of Population. Cham: Springer International Publishing, 2022. https://doi.org/10.1007/978-3-030-76433-3_2.

Wynes, Seth, and Kimberly A. Nicholas. 'The Climate Mitigation Gap: Education and Government Recommendations Miss the Most Effective Individual Actions'. *Environmental Research Letters* 12, no. 7 (July 2017): 074024. https://doi.org/10.1088/1748-9326/aa7541.

Zagheni, Emilio. 'The Leverage of Demographic Dynamics on Carbon Dioxide Emissions: Does Age Structure Matter?' *Demography* 48, no. 1 (17 February 2011): 371–99. https://doi.org/10.1007/s13524-010-0004-1.