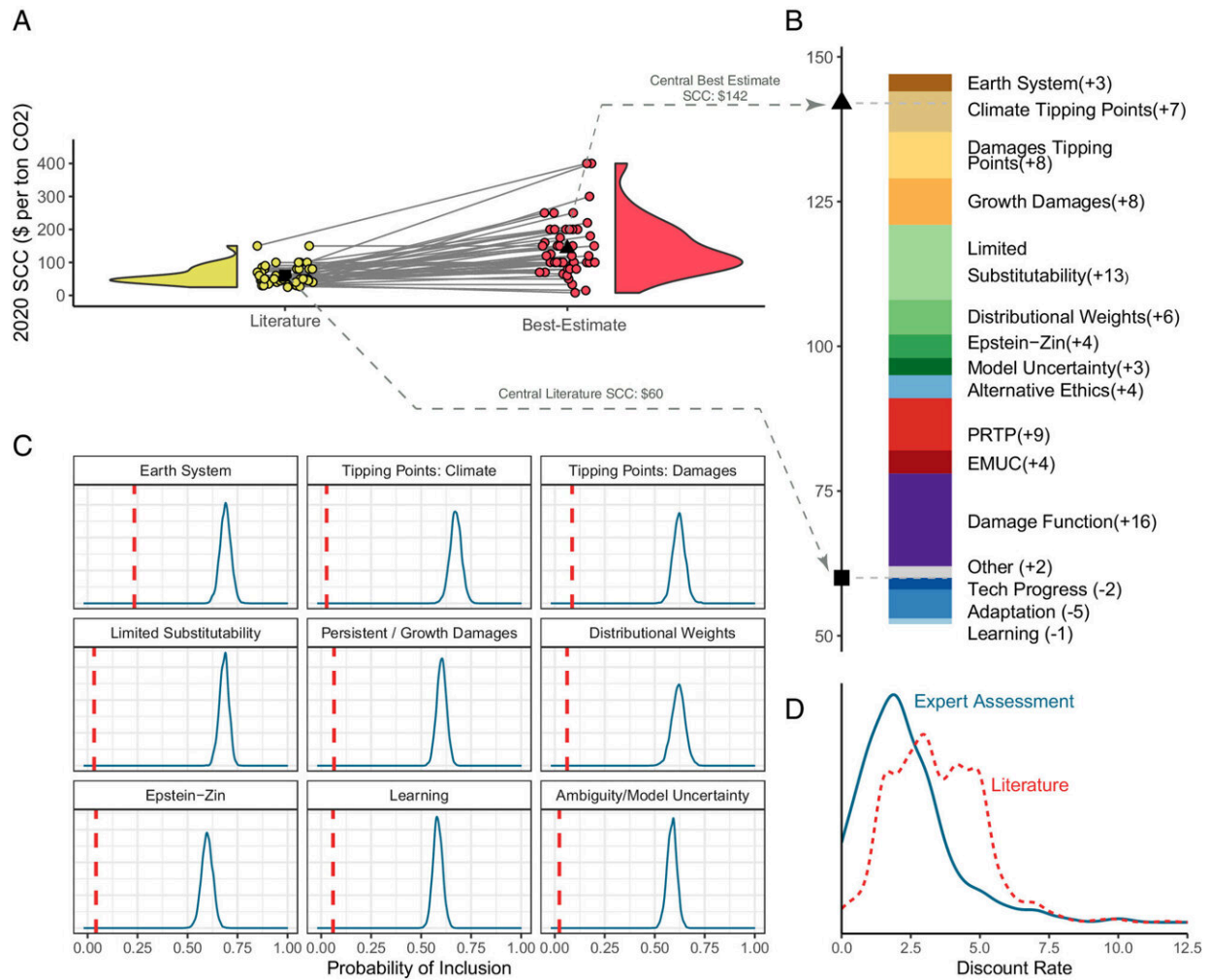


The social cost of carbon: Study finds current estimates omit key effects

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Expert survey on SCC values, model structure, and discounting. Credit: *Proceedings of the National Academy of Sciences* (2024). DOI: 10.1073/pnas.2410733121

The social cost of carbon—an important figure that global policymakers use to analyze the benefits of climate and energy policies—is too low, according to a study led by the University of California, Davis.

The study, [published](#) in the journal *Proceedings of the National Academy of Sciences*, shows that current estimates for the social cost of carbon (SCC), fail to adequately represent important channels by which climate change could affect human welfare. When included, the SCC increases to just over \$280 per ton of CO₂ emitted in 2020—more than double the average published in the academic literature. The study's estimate is also larger than the U.S. Environmental Protection Agency's central estimate of \$190 per ton of CO₂.

"When people worry about climate change, they worry about the risk and uncertainty it causes," said lead author Frances Moore, an associate professor in the Department of Environmental Science and Policy at UC Davis.

"They worry about long-term, persistent accumulating effects, such as climate change acting as a drag on [economic growth](#). They worry about impacts to very unique natural systems or cultural heritage that are just irreplaceable. Those are what keep people up at night about climate change, and those are not fully included in SCC estimates currently used for policymaking."

Climate change and the damage done

The social cost of carbon quantifies the damage a ton of carbon dioxide has on society and the economy, including food production, human health, property damage due to natural disasters and impacts to natural systems. Estimates of the SCC are used widely in policy analysis, particularly to value the benefits of reducing greenhouse gas emissions. The United States, Germany, Canada and several states all have official

SCC estimates used for policymaking.

Most current government estimates, the study said, are incomplete and likely underestimate the benefits of reducing [greenhouse gas emissions](#). This is because they omit some important ways [climate change](#) can affect human welfare, including via economic growth or effects on unique natural systems.

The study combines evidence from both the published literature and a survey of experts to fully integrate these elements into the SCC estimate, providing the most comprehensive assessment of SCC estimates to date.

Accounting for omissions

For the study, the authors synthesized 1,800 SCC estimates from the academic literature over the past 20 years and found a wide range of published values averaging \$132 per ton of CO₂.

The scientists also conducted an expert survey with the authors of the literature, who said they thought the true value of the SCC was likely twice as large as the average of published values. Experts attribute this to a range of omissions in the academic literature, including limited representation of climate tipping points, effects on scarce ecosystems, or climate impacts with long-lived effects on the economy such as impacts on economic growth.

The authors then used machine learning to re-weight the literature, partially correcting some of the omissions identified by experts and using more recent evidence on discount rates. This produced a distribution of the 2020 SCC with a mean of \$283 per ton of CO₂ and an interquartile range of \$97 to \$369.

The study states, "Incorporating climate costs into the prices of

economic activities that emit greenhouse gases, either directly through carbon pricing or indirectly through emission regulation or subsidies of cleaner alternatives, is essential for averting the worst climate outcomes."

The study's co-authors are Moritz Drupp from the University of Hamburg, James Rising from the University of Delaware, Simon Dietz from the London School of Economics and Political Science, Ivan Rudik from Cornell University, and Gernot Wagner from Columbia Business School.

More information: Frances C. Moore et al, Synthesis of evidence yields high social cost of carbon due to structural model variation and uncertainties, *Proceedings of the National Academy of Sciences* (2024). [DOI: 10.1073/pnas.2410733121](https://doi.org/10.1073/pnas.2410733121)

Provided by UC Davis

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