

Study finds Amazon River carbon dioxide emissions nearly balance terrestrial uptake

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New study finds Amazon River emits as much carbon as the forest stores with major implications for global climate policy. Credit: Nick Ward

Forests have always been considered huge carbon stores, helping to absorb greenhouse gas emissions, but new research in Brazil has found that rivers in the Amazon emit far more carbon dioxide (CO₂) than previously estimated, suggesting that the Amazon Basin is closer to net carbon neutral. The results increase the most recent global estimates of CO₂ emissions from rivers and lakes by almost 50%, with potentially huge implications for global climate policy.

Published in the journal *Frontiers in Marine Science*, the paper led by Dr. Henrique Sawakuchi from the Center of Nuclear Energy in Agriculture, at the University of São Paulo, the research provides the first detailed evaluation of CO₂ concentrations and fluxes along the lower Amazon River and its major tributaries, the Xingu and Tapajós rivers. This focus on the lower Amazon River is important because, currently, it represents around 13% of the total drainage basin area and is not included in estimates of basin-scale CO₂ outgassing - [carbon](#) emissions derived from the decomposition of terrestrial and aquatic vegetation. Original CO₂ outgassing estimates for the Amazon presented in 2002 were based on a conservative upscaling of measurements made in the central basin, which have since been revised with more detailed observations.

For the first time, between 2014-16 direct measurements of CO₂ outgassing were made in the tidally-influenced lower river using floating domes during different hydrologic periods (i.e., low, rising, high, and falling water). Measured outgassing rates were similar to those measured previously in the central Amazon River despite the fact that CO₂ concentrations slightly decrease towards the river mouth. This is because wind and wave conditions become more turbulent as the river widens and becomes exposed to the coast, expediting gas transfer between the river and the atmosphere. Another consequence of the widening river channel is that the river's surface area rapidly expands, resulting in the massive overall outgassing flux for this region relative to upstream.

One of the study's co-authors, Dr Nicholas Ward, from the Marine Sciences Laboratory at the US Pacific Northwest National Laboratory says this research shows that global estimates of CO₂ emissions from inland waters have not in the past been properly accounted for, "we typically ignore the lower reaches of rivers that become influenced by tides because they are highly complex; in the case of the Amazon this represents a 1000 km reach of the river that has been ignored in global carbon budgets."

The researchers combined their new CO₂ emission estimates for the lower Amazon with an updated evaluation of the entire Amazon Basin, resulting in a 43% increase in the latest global estimates of CO₂ outgassing from rivers and lakes.

"These increasing emission estimates in the Amazon alone, which still don't consider the tidal reaches of other large rivers, suggest that the terrestrial biosphere does not absorb as much anthropogenic CO₂ as previously assumed", says Dr Ward, with serious implications for global climate policy, "Politicians and policy makers should recognize that the presence of a tree does not imply carbon sequestration, per se, we must track the history of carbon as it moves from land to sea".

The study's authors, who have just returned from further exploration of the unstudied mouth of the Amazon River, hope that this study will catalyze further research into our understanding of earth systems and the global carbon cycle.

This research is part of a broader Frontiers collection of articles around [why understanding of biogeochemical pathways across riverine, estuarine, and marine gradients is a critical step in constraining global energy and carbon budgets under past, present, and future climate scenarios.](#)

More information: Henrique O. Sawakuchi et al, Carbon Dioxide Emissions along the Lower Amazon River, *Frontiers in Marine Science* (2017). [DOI: 10.3389/fmars.2017.00076](https://doi.org/10.3389/fmars.2017.00076)

Provided by Frontiers

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