# Greenhouse gas emissions from reservoirs higher than previously expected

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A new study in *Global Biogeochemical Cycles* shows per-area greenhouse gas emissions from the world's water reservoirs are around 29% higher than suggested by previous studies, but that practical measures could be

taken to help reduce that impact.

Much of the increase in emissions comes from previously unaccounted for methane degassing, a process where methane passes through a dam and bubbles up downstream, according to the analysis by Washington State University and University of Quebec at Montreal scientists.

Overall, the researchers found the world's water reservoirs are annually producing methane, carbon dioxide, and other greenhouses gases in an amount roughly equivalent to 1.07 gigatons of carbon dioxide.

While that amount is small in comparison to the more than 36 gigatons of greenhouse gas emissions produced by fossil fuels and other industrial sources each year, it's still more greenhouse gas than the entire country of Germany, the globe's sixth largest emitter, produces annually. It is also roughly equal in weight to 10,000 fully-loaded U.S. aircraft carriers.

Led by John Harrison, a professor in the WSU Vancouver School of the Environment, and co-authored by colleagues at the University of Quebec at Montreal, the study is the first to include methane degassing in its estimate of global greenhouse gas emissions from manmade reservoirs.

The research team also factored in numerous other unaccounted for variables into their analysis such as water temperature, water depth and the amount of sediment entering into thousands of different reservoirs located around the world. Previous studies that calculated overall greenhouse gas emissions from reservoirs relied solely on average emission rates per reservoir surface area.

"While a number of papers have pointed out the importance of aquatic systems as sources of methane to the atmosphere, this is the first paper that I know of to look explicitly at which kinds of reservoirs are big sources and why," Harrison said. "It gives us the ability to start working

toward understanding what we could do about methane emissions from these types of systems."

Decomposing plant matter near the bottom of reservoirs fuels the production of methane, a greenhouse gas that is 34 times more potent than carbon dioxide over the course of a century and comparable to rice paddies or biomass burning in terms of overall emissions.

Harrison and colleagues found methane degassing accounts for roughly 40% of emissions from water reservoirs. This large increase in previously unaccounted for emissions was partly offset by a projected lower amount of methane diffusing off the surface of reservoirs, according to the analysis. Carbon dioxide emissions were similar to those reported in past work.

The researchers' findings reveal the highest rates of greenhouse gas emissions from reservoirs occur in the tropics and subtropics. An estimated 83% of methane emissions occurred within tropical climate zones.

These areas are also where the majority of ongoing and planned new reservoir construction projects are anticipated to occur in coming decades.

The findings are particularly important because it may be possible to reduce methane emissions downstream from reservoirs by selectively withdrawing water from near the reservoirs' surface, which tend to be methane-poor rather than from greater depths, where methane often accumulates.

For example, in a related study, a simulated decrease in water withdrawal depth by as little as 3 meters (about 10 feet) yielded a 92% reduction in methane degassing emissions from a Malaysian reservoir.

"We aren't saying that reservoirs are necessarily bad. Many provide important services like electrical power, flood control, navigation and water," Harrison said. "Rather, we want to bring attention to a source of greenhouse gas emissions that we think can be reduced in the years ahead as we work towards carbon neutral emissions."

Harrison's and colleagues work recently helped lead the Intergovernmental Panel on Climate Change, the leading international authority on the subject of global warming, to recognize reservoirs and flooded lands as an integral part of each country's overall emissions.

"We're interested in using this work to improve these models and global estimates," Harrison said. "One end goal of this work is to improve our ability to estimate the amount of greenhouse gases coming from reservoirs on a per country basis so that countries can address this source and include it in the way that they are managing their greenhouse gas liabilities."

**More information:** John A. Harrison et al, Year-2020 Global Distribution and Pathways of Reservoir Methane and Carbon Dioxide Emissions According to the Greenhouse Gas from Reservoirs (G-res) Model, *Global Biogeochemical Cycles* (2021). DOI: 10.1029/2020GB006888

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