

# Reservoirs play substantial role in global warming

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A recent photo of a reservoir on the Snake River in Washington. Credit: Shelly Hanks, WSU Photo Services

Washington State University researchers say the world's reservoirs are an underappreciated source of greenhouse gases, producing the equivalent

of roughly 1 gigaton of carbon dioxide a year, or 1.3 percent of all greenhouse gases produced by humans.

That's more [greenhouse gas](#) production than all of Canada.

Writing in next week's journal *BioScience*, the WSU researchers say [reservoirs](#) are a particularly important source of [methane](#), a greenhouse gas that is 34 times more potent than carbon dioxide over the course of a century. Reservoir methane production is comparable to rice paddies or biomass burning, both of which are included in emission estimates of the Intergovernmental Panel on Climate Change, the leading international authority on the subject.

John Harrison, co-author and associate professor in the WSU Vancouver School of the Environment, last month attended a meeting in Minsk, Belarus, to discuss including reservoir emissions in a planned 2019 IPCC update of how countries report their greenhouse gas inventories.

## **Methane accounts for 80 percent**

"We had a sense that methane might be pretty important but we were surprised that it was as important as it was," said Bridget Deemer, WSU research associate and lead author. "It's contributing right around 80 percent of the total global warming impact of all those gases from reservoirs. It's a pretty important piece of the budget."

The *BioScience* analysis, which drew on scores of other studies, is the largest and most comprehensive look to date at the link between reservoirs and [greenhouse gases](#), Harrison said.

"Not only does it incorporate the largest number of studies," he said. "It also looks at more types of greenhouse gases than past studies."

Acre per acre, reservoirs emit 25 percent more methane than previously thought, he said.

The researchers acknowledge that reservoirs provide important services like electrical power, flood control, navigation and water. But reservoirs have also altered the dynamics of river ecosystems, impacting fish and other life forms. Only lately have researchers started to look at reservoirs' impact on greenhouse gases.

"While reservoirs are often thought of as 'green' or carbon neutral sources of energy, a growing body of work has documented their role as greenhouse gas sources," Deemer, Harrison and their colleagues write.

## **Gases from decomposing organic matter**

Unlike natural water bodies, reservoirs tend to have flooded large amounts of organic matter that produce carbon dioxide, methane and nitrous oxide as they decompose. Reservoirs also receive a lot of organic matter and "nutrients" like nitrogen and phosphorous from upstream rivers, which can further stimulate greenhouse gas production

In 2000, *BioScience* published one of the first papers to assert that reservoir greenhouse gases contribute substantially to global warming. Since then, there has been a nine-fold increase in studies of reservoirs and greenhouse gases. Where earlier studies tended to be confined to reservoirs behind power stations, the newer studies also looked at reservoirs used for flood control, water storage, navigation and irrigation.

The WSU researchers are the first to consider methane bubbling in models of reservoir greenhouse gas emissions. Also, while previous papers have found that young, tropical reservoirs emit more methane than older, more northern systems, this study finds that the total global

warming effect of a reservoir is best predicted by how biologically productive it is, with more algae and nutrient rich systems producing more methane.

The authors also report higher per-area rates of methane emission from reservoirs than have been reported previously. This means that acre-for-acre the net effect of new reservoirs on atmospheric greenhouse gases will be greater than previously thought. Reservoir construction around the globe is expected to proceed rapidly in coming decades.

## **Largest study of reservoir greenhouse gas emissions**

"There's been a growing sense in the literature that methane bubbles are a really important component of the total emissions from lake and reservoir ecosystems," said Deemer. "This study revisited the literature to try and synthesize what we know about the magnitude and control on methane emissions and other greenhouse gases—carbon dioxide and nitrous oxide."

The result is that, in addition to being the largest study of reservoir [greenhouse gas emissions](#) to date, it is the first to comprehensively look at the flow of all three major greenhouse gases—carbon dioxide, methane and nitrous oxide—from reservoirs to the atmosphere.

The work is in keeping with WSU's Grand Challenges, a suite of research initiatives aimed at large societal issues. It is particularly relevant to the challenge of sustainable resources and its themes of supplying food, energy and water for future generations.

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**More information:** [bioscience.oxfordjournals.org/ ...  
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Provided by Washington State University

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