

Stormwater ponds not a major source of greenhouse gas emissions

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Researcher Joanna Blaszczak collects samples from a stormwater pond in Miami, Fla. as part of a new study that finds the ponds, which are ubiquitous in most cities, aren't a major source of greenhouse gas emissions, as some scientists feared. Credit: Jim Heffernan, Duke Univ.



Stormwater retention ponds, a ubiquitous feature in developed landscapes worldwide, are not a significant source of climate-warming nitrous oxide (N2O) emissions, a new Duke University-led study finds.

Many factories, office buildings, airports, apartment complexes and retail centers, among other sites, use the ponds to collect runoff from roads, roofs, lawns and parking lots and filter out pollutants before the water is released into local streams or rivers.

Among the pollutants the ponds help remove is excess nitrogen, which, if left untreated, could spur oxygen-depleting algae blooms in downstream waters.

But some scientists question whether there may be a trade-off to this benefit, since the process by which the ponds reduce nitrogen in runoff also produces nitrous oxide, a <u>potent greenhouse gas</u> and destroyer of stratospheric ozone, as one of its by-products.

"Previous studies have suggested we might find elevated <u>nitrous oxide</u> <u>emissions</u> from these ponds, especially urban ponds where high levels of metal contaminants from road runoff might interfere with the complete reduction of the nitrogen," said Joanna Blaszczak, a 2018 doctoral graduate of Duke's Nicholas School of the Environment, who led the study.

"Our research, which looked at 64 retention ponds in eight different cities and ecoregions across the nation, found no apparent trade-off," she said.

Blaszczak and her colleagues published their peer-reviewed study June 29 in the journal *Ecosphere*.





Google Earth images of stormwater ponds included in a new study that finds the ponds aren't a major source of greenhouse gas emissions, as some scientists feared. Credit: Duke University

To conduct the study, they collected and analyzed sediment samples from stormwater ponds in Boston, Baltimore, Miami, Minneapolis, Phoenix, Salt Lake City, Portland, Ore., and Durham, N.C., during summer 2014. Three samples each were collected from eight ponds in each city. Some ponds received runoff from heavily developed areas; some received runoff from moderately or lightly developed areas; and some were in largely undeveloped areas.



The researchers measured the samples for nitrogen and metal concentrations and for the abundance of certain microbial genes that regulate the denitrification process in <u>pond</u> sediment. Samples were then incubated and placed in water-filled glass bottles for six hours, so the researchers could measure how much nitrous oxide was created and emitted.

"We found there was almost no correlation, no single and simple link, between the intensity of nearby urban land cover and potential denitrification rates, across and within all cities," Blaszczak said. The nitrous <u>oxide</u> yield from most ponds—even in heavily developed drainages—was within the range of rates found in freshwater bodies draining undeveloped landscapes.

"This leads us to conclude that urban stormwater ponds are not likely to be important sources of <u>nitrous oxide</u> to the atmosphere," she said.

While the study's findings should help allay concerns that the ponds could be a major source of greenhouse gas emissions, other questions remain unanswered.

"Stormwater ponds are essentially black boxes," Blaszczak said. "We understand what goes into them and what flows out of them, but still have limited understanding of the chemical and biophysical processes that occur within them."

"Many of our team's starting assumptions about how sediment chemistry would change with changing urban land use proved to be untrue," she said. "That's probably because urban ponds reflect previous land-use history as well as current land-use strategies. We're only beginning to figure it all out."

Blaszczak is now a postdoctoral research associate at the University of



Montana's Flathead Lake Biological Station.

More information: Joanna R. Blaszczak et al, Sediment chemistry of urban stormwater ponds and controls on denitrification, *Ecosphere* (2018). DOI: 10.1002/ecs2.2318

Provided by Duke University

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