New York City area wetlands may be unwitting generator of greenhouse gasses

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Soil samples were collected from Iona Island (seen here) and two other wetland area in the Hudson River Estuary and tested in a laboratory setting to determine if exposure to excess carbon pollutants stimulated production of methane and carbon dioxide emissions. Credit: Brian Brigham

New York City (NYC), located within the Hudson River Estuary, inputs over 100 billion liters of combined sewage overflow (CSO) into surrounding surface waters annually. Little is known, however, about the impact of CSOs on wetlands that act as carbon sinks and provide buffers against climate change. Now a new study in the *Soil Science Society of America Journal* from researchers at The Graduate Center of The City University of New York (GC/CUNY) and Queens College suggests that local wetlands are capable of using CSO inputs in a manner that actually increases greenhouse gas emissions such as carbon dioxide and methane.

"Combined sewage overflows are frequent occurrences in New York City and the surrounding area," said Brian Brigham, the paper's first author and a recent Ph.D. recipient from GC/CUNY's earth and environmental sciences program. "The city's system is nearly at capacity during dry weather, so after even small amounts of precipitation, the subsequent surface runoff results in untreated sewage flowing into surface waters. These overflows deliver large amounts of carbon and nitrogen to wetland soils, so we wanted to test how saturation of these elements impacted greenhouse gas production."

Methodology and Findings

Researchers collected soils from three wetland sites—Iona Island, Piermont, and Saw Mill Creek—of varied salinity and proximity to New York City for use in laboratory incubation experiments. To simulate what happens when CSO saturates Hudson River estuary wetland soils, the researchers added acetate—the simplest forms of organic carbon typically available in anaerobic soils—to one group of samples. To other groups they added inorganic nitrogen (nitrate and ammonium), which is typically found in human sources of pollution. The samples were incubated, and daily carbon dioxide and methane production measurements were taken and compared to production rates from a control group of soil samples.

The experiments demonstrated that the readily decomposable carbon additions enhanced methane production more than 100 times and carbon dioxide production by more than twice the rate of the control group. The addition of inorganic nitrogen had no such effect.

Significance

"New York City has to identify and quantify its various sources of greenhouse gas emissions in order to reduce its contribution to climate change," said Jeffrey Bird, a professor of biology and earth and environmental sciences at GC/CUNY and Queens College, a co-author of the study, and Brigham's research co-adviser. "Some of these potential sources—like local wetlands that receive significant carbon and nitrogen loading from New York City's sewage overflow—are indirect. We know about effects of this overflow on human health, but little work has been done to determine how they may contribute to the city's greenhouse gas footprint."

Overall, said the researchers, the findings suggest that NYC's environmental impact extends into nearby undeveloped aquatic ecosystems such as the Hudson River Estuary, and that the impact on the environment can be significant.

Brigham and his colleagues have already taken their research into the field to measure actual greenhouse gas concentrations and emissions from New York City surface waters (which includes the Hudson River, its tributaries, and several sites in and around the city) and the Hudson River estuary. An important next step will be gathering additional data on CSO's impact on nitrous oxide emissions.

More information: Brian A. Brigham et al, Acetate Additions Stimulate CO and CH Production from Urban Wetland Soils, *Soil Science Society of America Journal* (2018). DOI:

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