



On why the embankment matters when assessing greenhouse gas emissions from urban stormwater ponds

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Urban stormwater ponds (SWPs) are a common runoff control measure that can also have beneficial outcomes for water quality. However, pond emissions of greenhouse gases (GHGs), such as carbon dioxide (CO₂) and methane (CH₄), raise questions about the climate impact of SWPs. Here, we establish whole-system annual carbon budgets for two SWPs in the City of Kitchener, Ontario, Canada, to compare the open water CO₂ and CH₄ effluxes to other input and output fluxes of carbon. These include the fluxes of particulate and dissolved inorganic and organic carbon at the inlet and outlet points of the pond, plus those associated with the sediments accumulating in the ponds. In both SWPs, the open-water effluxes of CO₂ and CH₄ are small compared to the inflow, outflow, and burial carbon fluxes. The SWP sediment budgets further imply that a large fraction of the sediment accumulating in the ponds is supplied by erosion of the embankment. The accompanying delivery of soil organic matter, together with direct litter and organic detritus inputs from the vegetation surrounding the pond, serves as an important source of the open-water CO₂ and CH₄ emissions. The latter are therefore largely derived from atmospheric CO₂ fixed by the ponds' littoral and embankment vegetation. Consequently, although the SWPs open waters emit CO₂ and CH₄, the entire SWP engineered systems, including the embankment, act as net CO₂ sinks. Overall, our results point to the potential to design and manage SWPs for enhanced climate change mitigation.