Assessing the Value of Constructed Wetlands as a Nature-Based Climate Solution: Insights from Southern Ontario

Alexandra Haak[1], ***Gail L. Chmura***[2] *and I. Florin Pendea*[1]
[1]Lakehead University, Thunder Bay, ON, CAN
[2]McGill University, Montreal, QC, CAN

Constructed wetlands (CWs) are created for wastewater treatment, biomass production, water storage and flood retention, and wildlife habitat. Vegetated CWs also can also sequester carbon (C) in their soils and potentially contribute to mitigation of anthropogenic greenhouse gas (GHG) emissions. Although research has quantified GHG emissions in some CWs, it is largely unclear whether these systems can help or hinder GHG emissions reduction efforts. In this study, we report the GHG fluxes from two CWs from Southern Ontario (Canada) vegetated primarily by *Typha latifolia*, one permanently flooded, and one temporarily flooded. Greenhouse gas fluxes (CO_2, CH_4, and N_2O) were measured seasonally using the static, dark chamber method. CO_2 emissions were significantly higher in the permanently flooded wetland when compared to the intermittently flooded system during all seasons except winter. The annual CO_2 emissions in the permanently flooded wetland was 170±121 mg m^{-2} hr^{-1}, while in the drier wetland the average annual CO_2 emissions were 94±52 mg m^{-2} hr^{-1}. Average CH_4emissions were >21 times higher in the permanently flooded wetland (10±19 mg m^{-2} hr^{-1}) than the seasonally flooded wetland (0.4±0.5 mg m^{-2} hr^{-1}). Methane emissions peaked during drier summer conditions at the seasonally flooded site, but during fall at the permanently flooded site. Winter CH_4 emissions under ice cover of the permanently flooded system were comparable to the summer values at the drier site underscoring the importance of measuring cold season emissions in constructed wetlands for robust annual GHG flux assessments. Nitrous oxide emissions were negligible. Our results suggest that hydrological control in CWs is essential to reducing their global warming potential wetland as reduced flooding in the fall and winter could lead to substantially lower CH_4 emissions.