GHG emissions from Wetlands in the Canadian Prairies: Impacts of Land-Use Change and Environmental Drivers

Pascal H. Badiou[1]*, Matthew J. Bogard*[2]*, Lauren E. Bortolotti*[1]*, Sara H. Knox*[3]*, Laura L. Logozzo*[4]*, and Cynthia Soued*[2]

[1]Ducks Unlimited Canada, Institute for Wetland and Waterfowl Research, Stonewall, MB, Canada
[2]Universirty of Lethbridge, Department of Biological Sciences, Lethbridge, AB Canada
[3]McGill University, Department of Geography, Montreal, QC, Canada
[4]Hudson River Foundation, New York, NY, USA

Canada has aggressively adopted nature-based climate solutions, such as wetland conservation and restoration, to achieve its national greenhouse gas (GHG) targets. While these activities can sequester carbon and prevent the loss of wetland carbon stocks, there is considerable uncertainty in the estimates of achievable reductions due to the highly variable GHG emissions from these wetlands, particularly methane (CH_4). This presentation will share findings from an ongoing national-scale project focused on mineral soil wetlands, aiming to better constrain GHG emissions and understand their drivers. Through an extensive survey of wetlands in the Canadian Prairie Pothole Region, we demonstrate that emissions patterns of carbon dioxide (CO_2), CH_4, and nitrous oxide (N_2O) from aquatic habitats vary significantly between wetlands in cropland and those in perennial landcover. Wetlands in cropped landscapes exhibit double the aquatic diffusive emissions, primarily driven by CH_4. Our results indicate that CH_4 emissions are highly sensitive to land use, increasing with elevated phosphorus levels and lower sulfate content in cropped settings, despite higher organic matter content in wetlands within perennial landscapes. Additionally, our field surveys reveal that salinity constrains CH_4 emissions, and models that do not account for salinity overestimate CH_4 emissions by several orders of magnitude. Furthermore, these findings are corroborated by data from the first-ever deployment of Eddy Covariance flux towers in mineral wetlands of the Canadian Prairies. Overall, our results suggest that regionally specific emissions factors are more appropriate for national GHG inventory reporting and for evaluating the role of wetlands as nature-based climate solutions.