Supplementary Information

Increased methane emissions from boreal peatlands following linear disturbances

Percy Korsah[1], Scott J. Davidson[2] and Maria Strack[1]

1. Department of Geography and Environmental Management, University of Waterloo, Waterloo, ON, Canada

2. Département des sciences biologiques, Université du Québec à Montréal, Montréal, Canada

Supplementary Methods

Estimate of the contribution of tree stems to ecosystem methane flux

Tree stem methane (CH_4) flux was not measured at the time of the chamber flux measurements, but follow-up measurements were taken on 20 tree stems in August 2024 to assess the possible contribution of this pathway. Cylindrical chambers (Figure S1), 25 cm in diameter and 30 cm long were affixed around stems of black spruce of ~8 cm diameter at the Carmon Creek and Harmon Valley bog sites. The chamber was affixed ~1.3 m above the ground surface on the stem of the tree (i.e., at breast height) with rubber gasket attached to the chamber and sealed to the tree using zipties. The IP-fen site had experienced a severe wildfire in summer 2023 and no unburned stems were available for measurement in 2024. The chamber was connected to a portable GHG sensor and CH_4 flux was estimated based on the linear change in concentration over time. Measurements without a clear pattern of concentration change or with signs of leakage based on CO_2 concentration change in the chamber were repeated and only high-quality flux measurement were included in the estimates presented here.

Supplementary Note

We estimated flux as mass of CH_4 per area of stem released over time. Measured black spruce stem fluxes ranged from -0.61 to 0.39 mg CH_4 $(m^2\ stem)^{-1}\ day^{-1}$ with an average

value of -0.02 mg CH_4 (m^2 stem)$^{-1}$ day^{-1}. Given that the average value indicates a small uptake of CH_4, black spruce tree stems are unlikely to be an important source of CH_4 emissions to the atmosphere, indicating that our ground level measurements of fluxes provide a good estimate of ecosystem CH_4 flux in these peatlands. In fact, removal of the overstory of black spruce may instead remove a CH_4 sink from the system, indicating that the effect of seismic line disturbance quantified based on ground level measurements could be underestimated, although by only a small margin.