Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.28438

# Wildfire impacts on fluvial methane production in Northern Peatlands: new insight from radiocarbon and stable isotopes

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Annual global carbon dioxide (CO2) and methane (CH4) emissions from the surface of rivers are estimated to be 1.8 Pg and 27.9 Tg, respectively. In peatlands (which store ~25% total global soil carbon), terrestrial carbon loss into rivers and eventual outgassing represents a significant yet poorly constrained component of a peatland's carbon budget. The carbon storage capabilities of peatlands are at risk of destabilising in response to changing hydroclimate and pressure from land use. For example, wildfires can modify peatland hydrological connectivity and river carbon sources and chemistry. However, little is known about the subsequent implications of this upon river greenhouse gases. Here, we present coupled CO2 and CH4 radiocarbon and stable isotope data (Figure 1) from river catchments affected by wildfire in some of Europe's largest continuous peatlands - the Isle of Lewis and Flow Country. Preliminary results show that although river CH4 was consistently older than CO2, the relationship between their ages was mostly coupled. In the burnt sites however, the relative ages suggest that proportionally more CH4 was being generated with older carbon from deeper within the peat. Stable isotope (δ13C and δ2H) data from the burnt catchment shows a stronger signal of hydrogenotrophic methanogenesis (CO2 reduction to CH4 by microbes), compared with the otherwise dominant pathway in which CH4 is oxidised to CO2. These results highlight the potential sensitivity of river greenhouse gas production pathways to changes in river chemistry and terrestrial carbon inputs caused by wildfire.

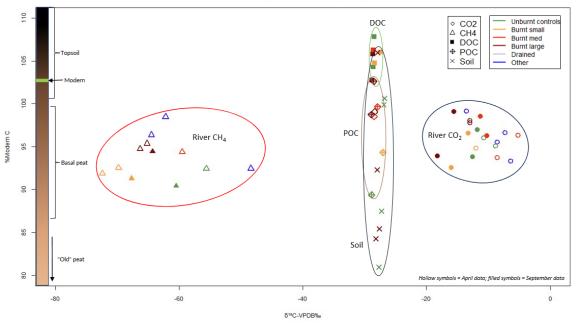

Figure 1. Percent Modern carbon and δ13C of river $CO_2$ and $CH_4$ sampled from April 2022 – April 2024.