UNIVERSITY OF OXFORD

RIV-ESCAPE

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RIV-ESCAPE: GREENHOUSE GAS EMISSIONS FROM PEATLAND STREAMS

Catherine Baldwin[1], Josh Dean[2], Mark Garnett[3], Hilde Cronwright[1], Andrew Smith[4], Bob Hilton[1]

1.Department of Earth Sciences, University of Oxford; 2. School of Geographical Sciences, University of Bristol; 3. NEIF Radiocarbon Laboratory, East Kilbride; 4. British Geological Survey, Keyworth.
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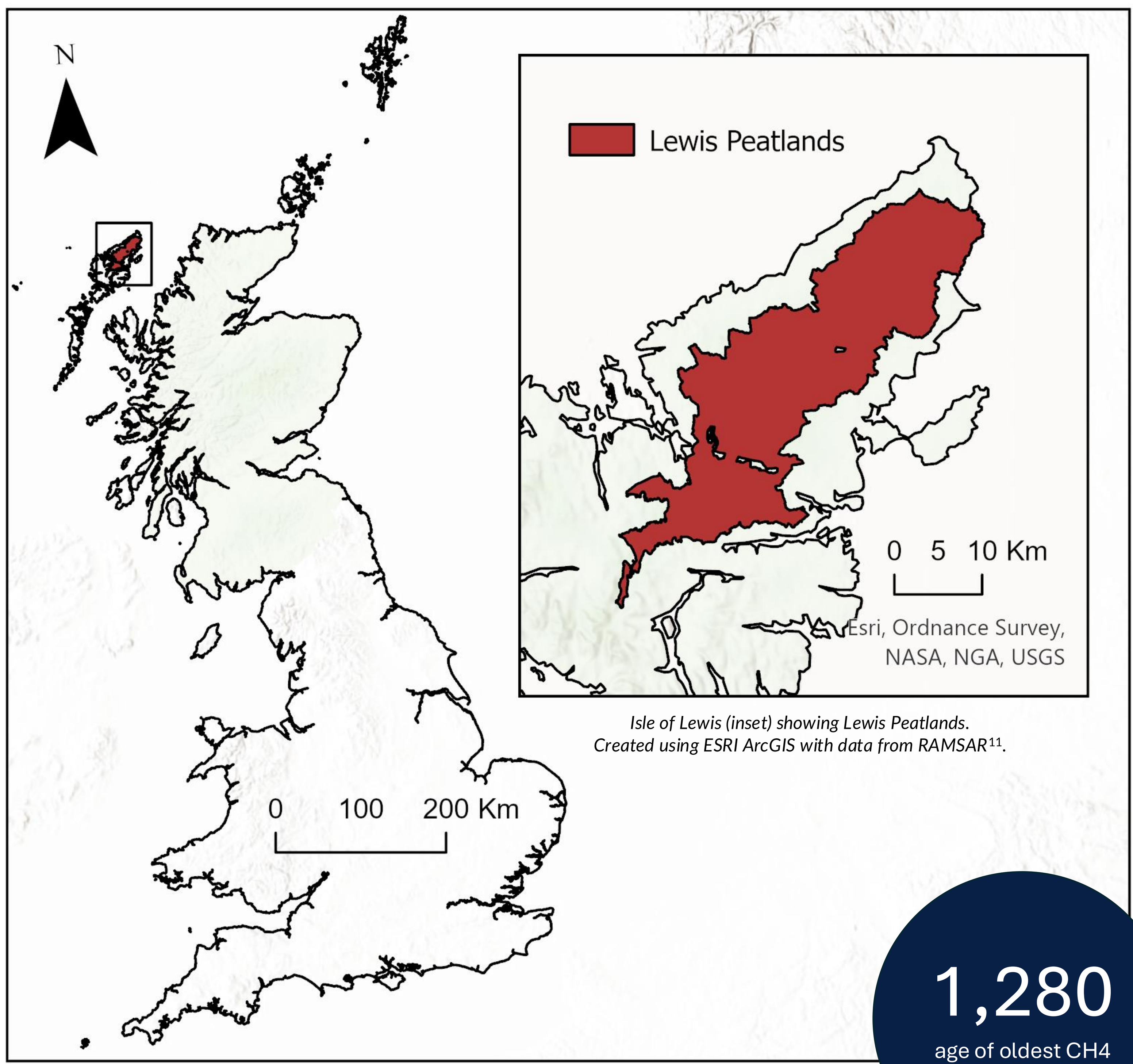
22
Total number of sample sites



Isle of Lewis (inset) showing Lewis Peatlands. Created using ESRI ArcGIS with data from RAMSAR[11].

1,280
age of oldest CH4 sample (yBP)

1. Project overview

Peatlands cover just ~3% of the Earth's surface[1] but hold approximately one third of the global soil carbon (C) stock[2]. These ecosystems are sensitive to disturbance such as wildfire[3] and anthropogenic pressures[4], which can mobilise C into rivers which would otherwise remain stored in soil[5,6].

Rivers are active C processors and transporters[7], interlinked with the terrestrial, marine, and atmospheric C pools[8,9]. Annual global riverine carbon dioxide (CO_2) and methane (CH_4) emissions represent a significant component of the global C cycle[10,11]. However, these fluxes and their drivers are poorly constrained[10,11]. In carbon-rich ecosystems such as peatlands, an increase in the mobilisation of terrestrial C into rivers could result in an increase in aquatic greenhouse gas (GHG) emissions[5].

The aims of this project are to:

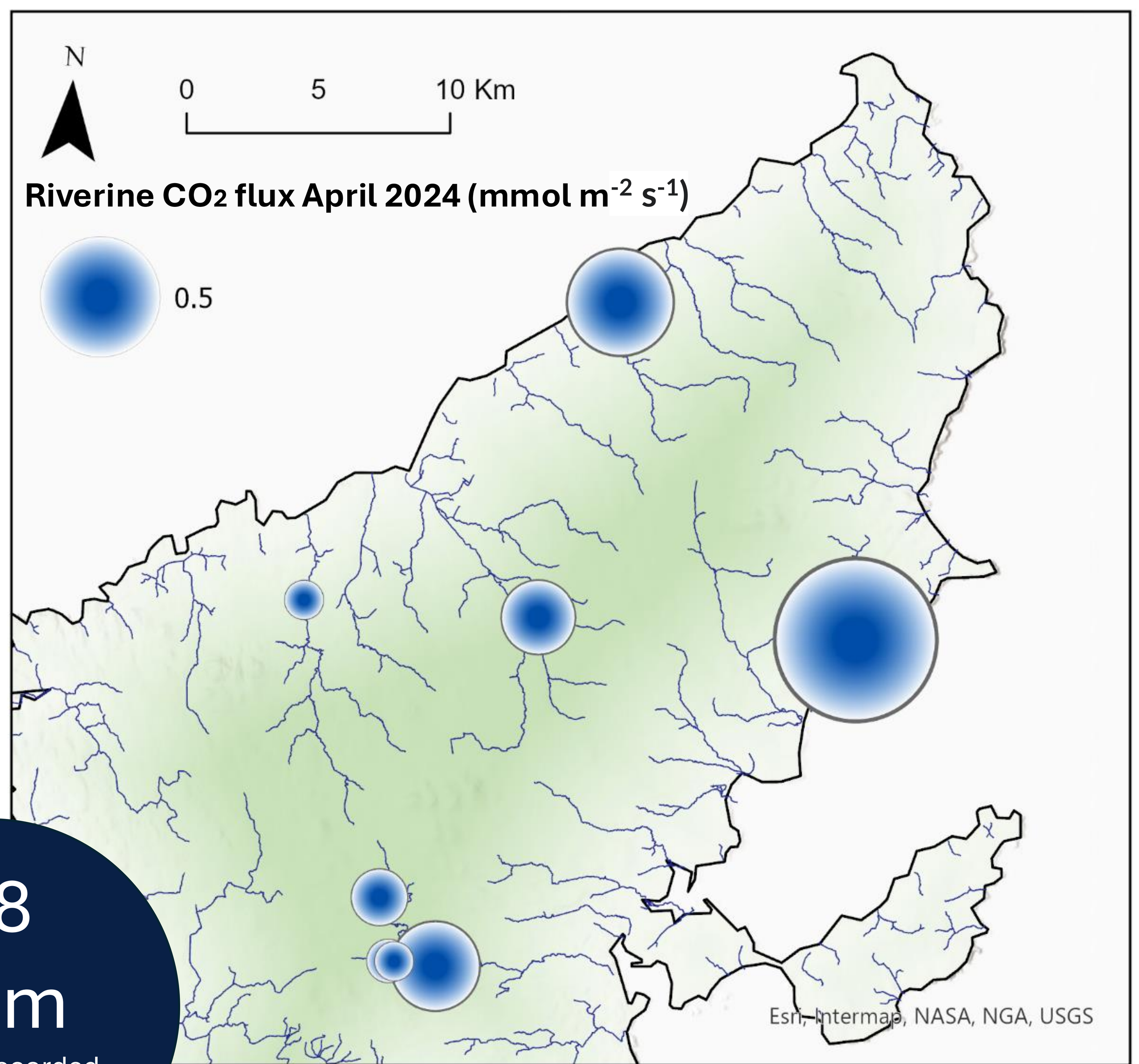
- **Constrain the CO_2 and CH_4 emissions from Lewis rivers**
- **Determine the age and source of riverine CO_2 and CH_4**
- **Identify drivers and potential impacts of climate and land use change.**

2. Methods

The Lewis Peatlands are one of the UK's largest expanses of peatland, resembling upland blanket bog but with a unique marine bioclimatic influence[12]. The area is impacted by peat cutting and is undergoing restoration work in places[13]. The peat in this study area has been measured to be <6m thick[14], and blankets extensive glacial till and a bedrock of predominantly Lewisian gneiss[15].

The RIV-ESCAPE project employs novel field and geochemical techniques. Key methods include:

- Floating chamber to measure river surface GHG emissions[16];
- Headspace method[17] to collect dissolved CO_2 and CH_4;
- Radiocarbon and $\delta^{13}C$ isotopic analysis to determine age and source[18];
- Water isotope and chemistry analysis to trace hydrological and geochemical processes[6,19]
- Remote sensing and GIS work to map catchment and landscape characteristics.



68 ppm
Highest recorded river CH4 concentration

3. Results and future work

Preliminary results from fieldwork in April 2024 show substantial spatial variations in dissolved gas concentrations and riverine GHG fluxes. Isotopic analysis highlighted notable differences in the age (^{14}C) and potential source ($\delta^{13}C$) of this carbon across the island.

These findings will be combined with the river chemistry data, geospatial analysis, and long-term sampling to create a comprehensive dataset. We can then begin to unravel spatial and temporal trends within the data and better constrain the magnitude and drivers of these emissions.

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