MOTHERSHIP is a five-year (April 2022-2027), £3.7m international research project to assess the risk that climate change poses to peatlands. The project is a collaboration between funded partners James Hutton Institute; UKCEH; and the Universities of the Highlands and Islands, Leeds, Nottingham and Exeter and 23 (at project start) project partners providing in-kind support .

At the end of project year 1, progress was expected for 8 of 15 project objectives and two impact activities. We report progress on six of these live areas of delivery; as the remaining two areas only recently started. A social media presence for the project has been created on @PeatMothership (314 followers) and @PeatMothership@fediscience.org (21 followers). A basic website was completed. In addition to the original project partners, 16 new partners were attracted to the project since its' start in April 2022.

O1) Form a coordinated national observing network based on harmonised measurement protocols and centralised data processing.

The project network currently contains a potential 68 sites, although not all stations are live at present. Standardised protocols for the gapfilling of fluxes are still being tested, as especially for methane there are no international standard protocols. Site characterisation at the UK core sites has begun and methods for these are being tested and shared. Leeds and Nottingham partners each ran a workshop to teach methods for soil ecohydrological characterisation. For partner sites outside of the core UK network, a data gathering exercise was started to establish what flux and ancillary data is available at each station. All of the above information is being compiled into a basic metadatabase.
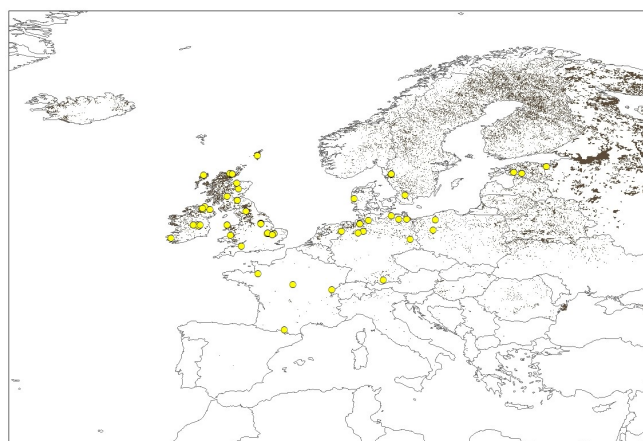
O2) Synthesise driving variables, below-ground measurements and GHG emissions for JULES-PEAT development.

At present, various physiological ecosystem properties have been extracted for the UK core network sites on the basis of their eddy covariance data. This data extraction exercise will also be extended to partner data soon. We have also begun to compile available information on vegetation communities within the station flux footprints and whether water table depth or soil moisture dynamics are monitored within the footprints or wider surrounding area. This information will feed into the development work in WP2 on O6 (see below) and ultimately feed back to this objective by delivering a standardised assessment of the spatial heterogeneity of vegetation communities, water table and soil moisture dynamics across the network sites.

O3) Test whether the joint effect of drainage/rewetting and climate extremes is a major modifying variable of C emissions.

At present, 18 of the network stations have data records of >5 site-years for CO_2 fluxes, and at least 8 stations look to have data records of >5 years (or close to 5 years) for CH_4 fluxes. The core UK network data out of this potential pool of long-term observations have been used for initial evaluations of statistical time series approaches to detect impacts of management and climate extremes. As per programme plan, this analysis will evolve as more network sites generate data series of >5 site years.

O6) Create a drainage classification based on modelled water table depth (median and range) of temperate peatlands as input for JULES-PEAT and vegetation classification as model validation.

At present, a modelling approach based on Sentinel series satellite data and which was recently tested for a pilot area within the core UK network (Toca et al., 2023) is being assessed for applicability across the network stations in 'point mode' to test fit against observed water table dynamics. A workflow has been built and is currently being tested to allow modelling across a wider spatial area, initially in a small series of test regions around some of the golden sites (see O7). The workflow also includes training of a classification model component of plant functional types (PFTs) in a way that is compatible with the typical 'BigLeaf' approach of land surface models. At present, a unified classification scheme has been developed which can be applied to the UK core site network, but still requires to be tested for European partner sites.

O7) Understand fine-scale spatial variability in peatland ecohydrological state at landscape scale around exemplar (golden) sites.

Work started in April 2023. At present, a shortlist of potential golden sites from the 68 sites in the network has been drawn up, based on providing an optimal set of sites covering bog and fen peatlands with as wide a gradient of management as possible, consideration of the extent and configuration of peatland and land use on peatland areas within 100 km areas around sites, and assessment of any potential challenges in application of InSAR (e.g., areas with coastal flooding, mountain environments). This shortlist is due to be discussed with the project partners and finalised at the May 2023 Glasgow meeting.

O14) Ensure optimal process representation and parameterisation of peatland processes in JULES-PEAT via focussed international model development workshops.

The initial focus was on establishing a new Peat sector within ISIMIP (https://www.isimip.org/about/#sectors-and-contacts). A highlight of this work to date is the completed development of a specific ISIMIP3 simulation protocol (https://protocol.isimip.org/).

Impact activities

Several online workshops have been run to support the development of the ISMIP3 simulation protocol (see O14). Our social media presence has been actively managed by our dedicated Science Communicator. With regards to activities aligned with the #generationrestoration UN Decade on Ecosystem Restoration, the project co-ordinator acted as peer reviewer for the Summary for Policy Makers and several chapters of the Global Peatland Assessment (https://www.unep.org/resources/global-peatlands-assessment-2022). We have held two general update meetings, and two specific workshops, with our project partners to date.