

Peat mapping

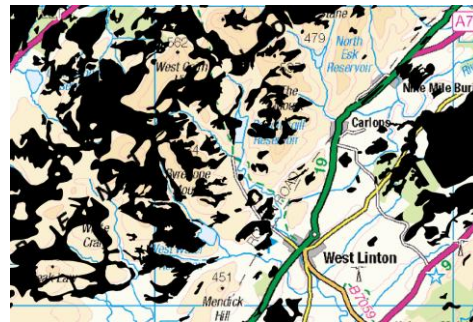
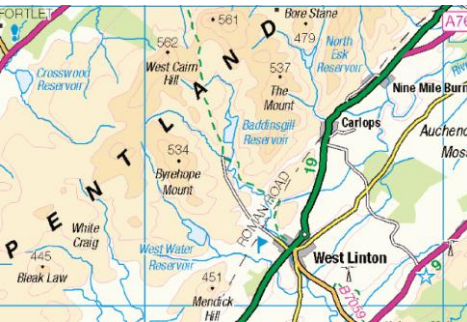


The James
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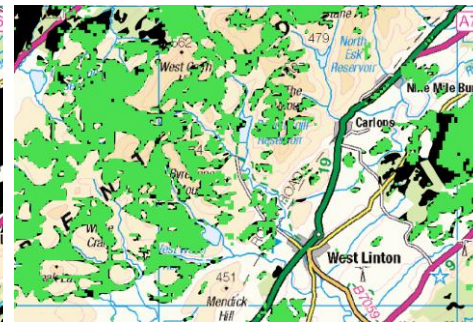
Ciaran Robb, Malcolm Coull, Doug Wardell-Johnson, Adnan Khan, Dave Miller, Keith Matthews, Jeff Thompson

Context and overview

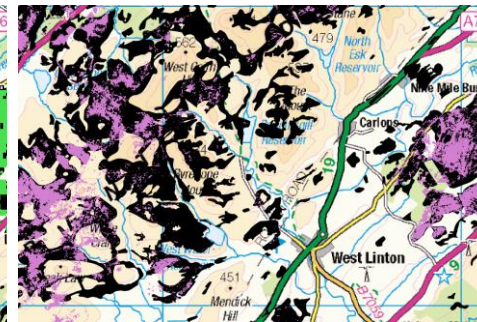
- Understanding the spatial extent of peatlands is an important step in estimating the amount of carbon contained within Scotland's peatlands.
- Recent work by the Hutton team has focused on updating and increasing the spatial resolution of Scottish peat maps.



1: 25k Partial Cover Soils
Map mapped peat

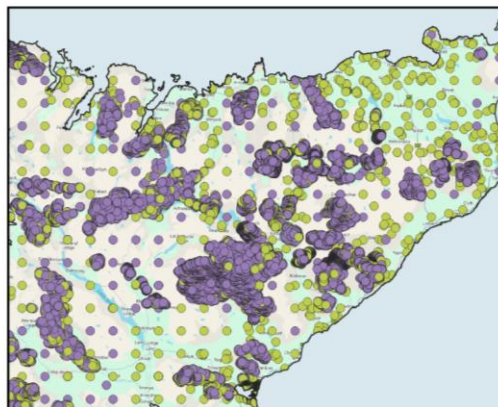
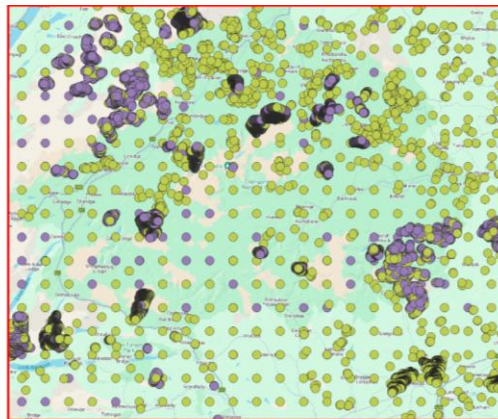
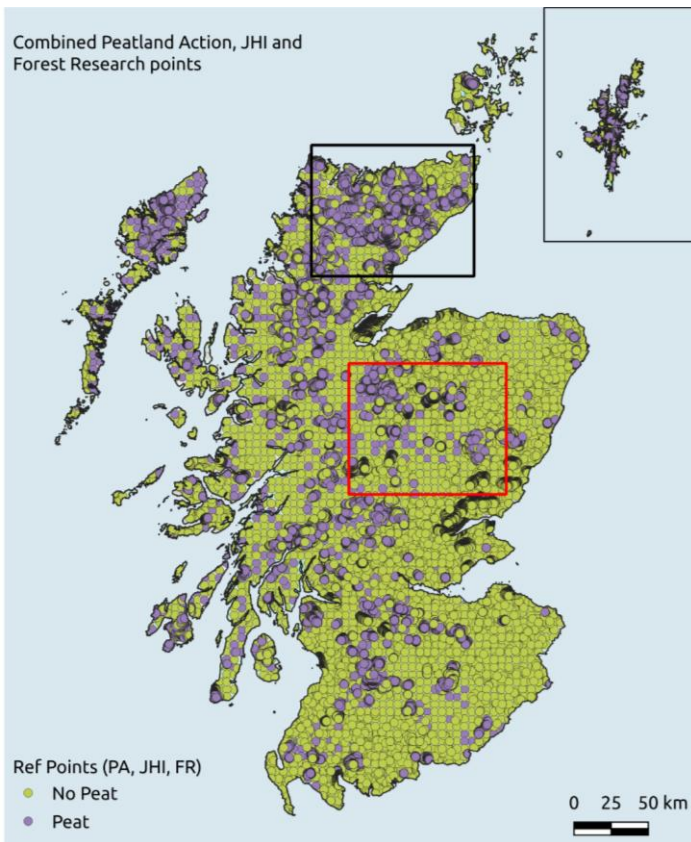


100 m peat
Aitkenhead 2017



10 m peat
Robb et al. 2025

Data collation & harmonization



The first phase of recent peat mapping was to gather and collate available peat observations. These include observations from: National Soils Database (JHI), Forest Research (FR) as well as Peatland Action (PA). In total, more than 278k ground-based were collated and harmonized

The green points represent areas without peat, and the purple areas are locations where peat has been identified. Note that for the NSD, locations within Scotland are a mix of systematically surveyed points using regularly gridded spatial locations, and ad hoc locations. The PA and FR locations are ad hoc samples, that predominantly target areas where peat was previously identified or was suspect to exist. Even in areas where peat was identified, measurements of peat depth do not always confirm peat: measured depths < 50cm.

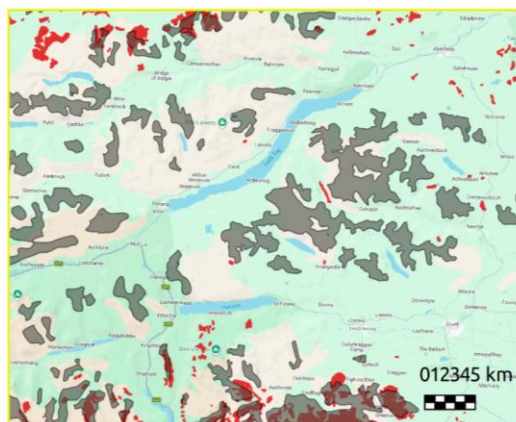
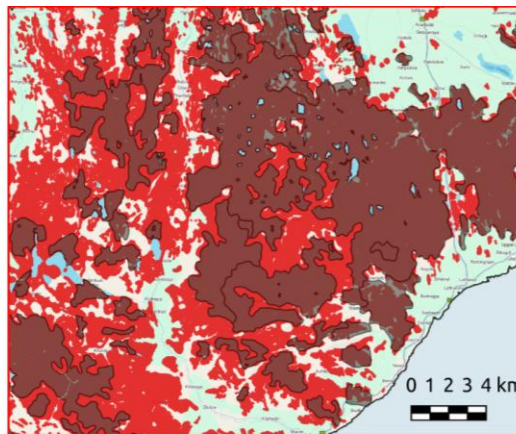
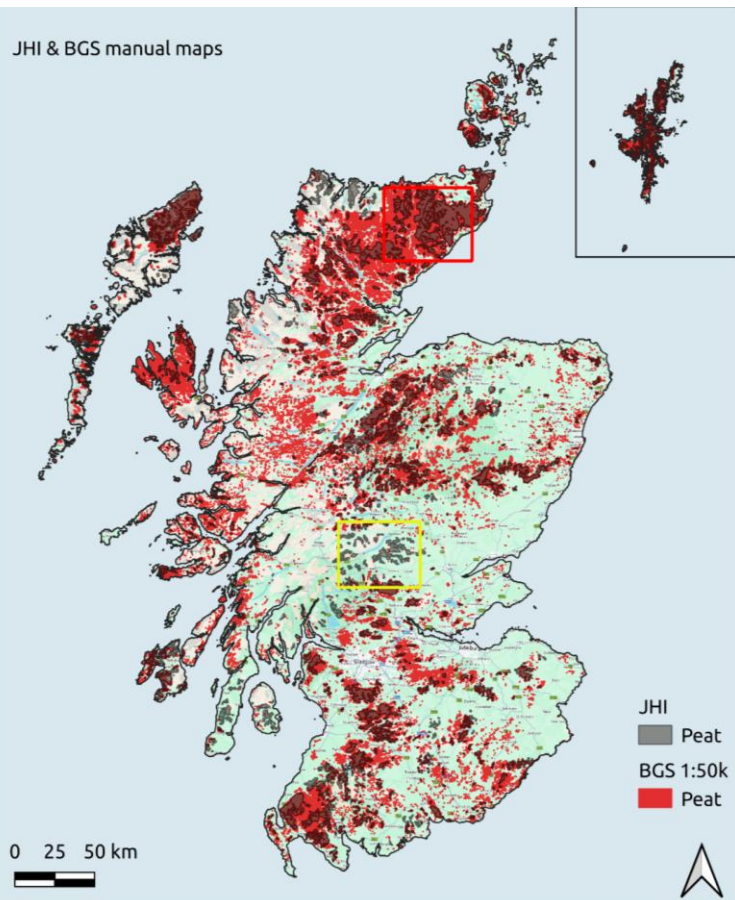
Comparison of mapping algorithms

Model	Comm. Error	Omis. Error	Mean Acc.	Area (km ²)
Embed Classifier (JHI 2025/6)	0.17	0.05	0.88	21,797
Hand-picked covs Classifier v2 (2025)	0.18	0.06	0.87	21,512
Hybrid agreement of ≥ 3 models	0.17	0.12	0.86	18,519
Hybrid45 agreement of ≥ 4 models	0.16	0.2	0.84	12,350
Peat depth regression Embed (2025)	0.24	0.04	0.84	29,369
Aitkenhead & Coull peat mask (2020 EJSS)	0.22	0.13	0.82	23,118
GHGI-baseline (Evans et al, 2017)	0.2	0.21	0.79	19,519
Robb, Aitkenhead et al 2025 (2025 EJSS, produced 2023)	0.18	0.34	0.73	12,033
BGS parent material map (includes peat) 1:50k	0.15	0.41	0.69	9,392
JHI Soil map (includes peat)	0.16	0.46	0.66	7,844



Models improve over time: mean accuracy increases and less peat is missed (omission error). Confusion between peat and non-peat is relatively stable; confusion inevitable when identifying peat (a subterranean soil feature) using surface features.

Limitations of older estimates



Comparison of older, manually derived estimates of peat extent: JHI and BGS. Generated using manual interpretation, these maps are not readily updated once published. Combined, and adjusting for hillslopes the JHI and BGS form the basis for the GHGI-baseline.

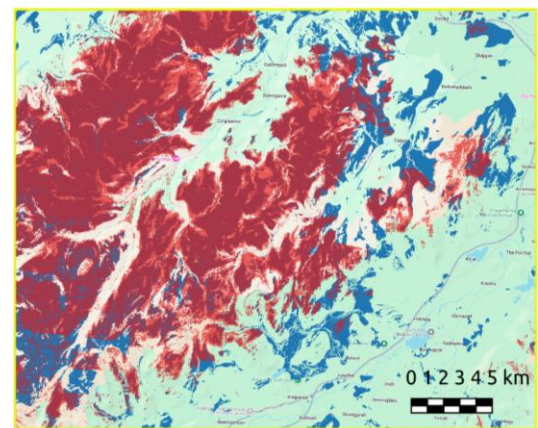
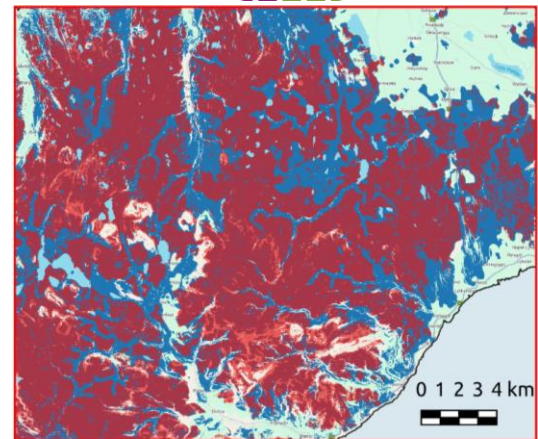
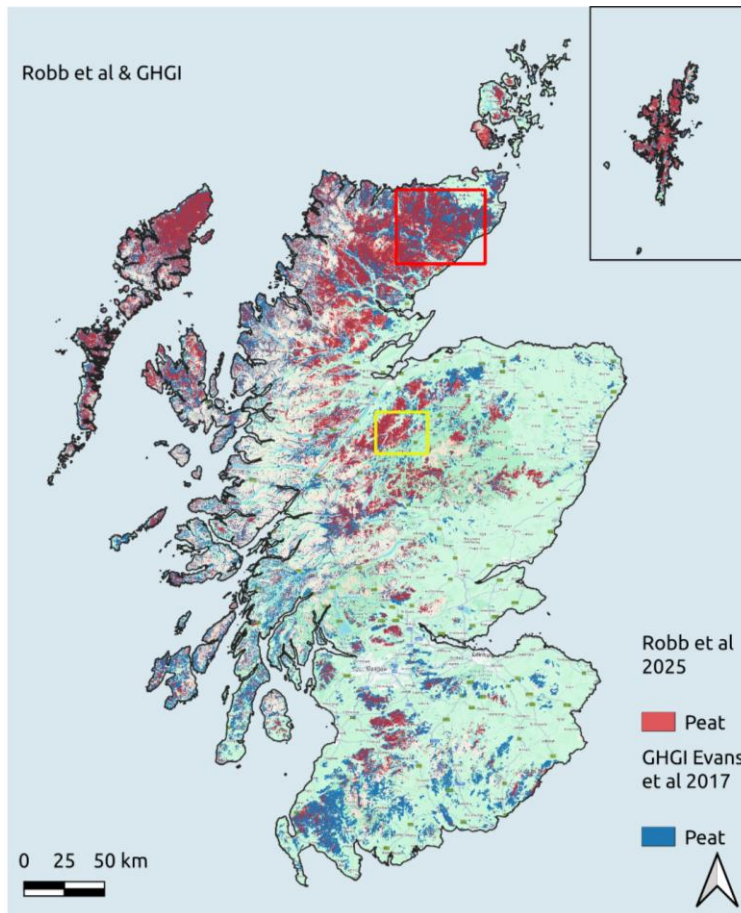
Peats comprise 7844 km² of the JHI map and 9392 km² on the BGS map. Note, were the definition of peat revised for Scotland, the JHI map contains ~29,000 km² of potential additional “peatlands”. There is reasonable correspondence between the JHI and BGS maps (red inset) though both failed to identify areas with peat (yellow inset).

The JHI and BGS maps represent the lower bounds for aerial estimates of Scottish peatlands.

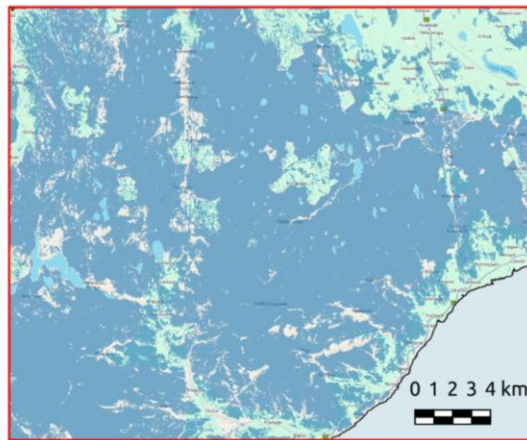
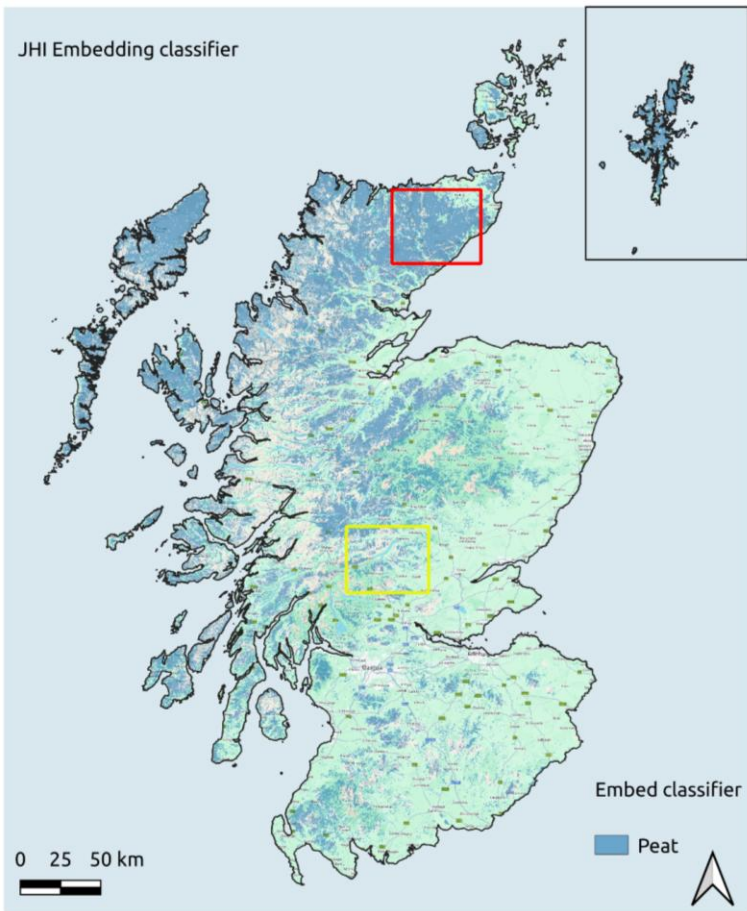
Improvements on older estimates

Recent Hutton maps improve upon the older greenhouse gas inventory (GHGI) map. Digital soil maps like this one allow for the maps to be improved with the acquisition of additional data, thereby increasing its relevance and currency.

The GHGI map has relatively consistent errors of omission and commission; error rates of both are approximately 20%. Though the GHGI exhibits better accuracy than manual methods, other modern models explored in this project produce better results still.



Hybrid & AI prototypes show promise



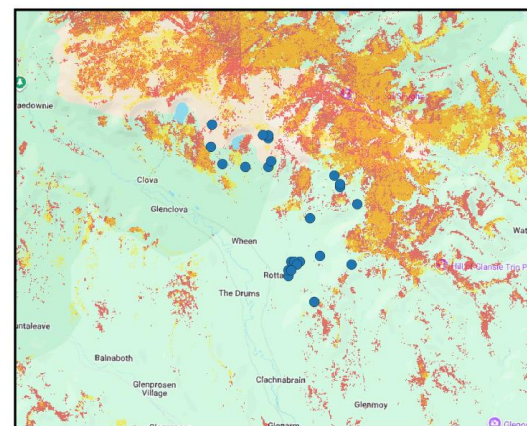
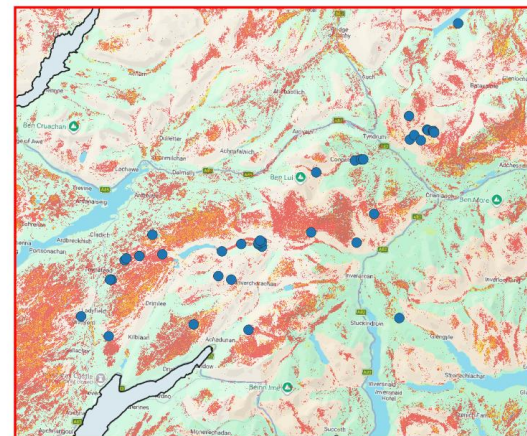
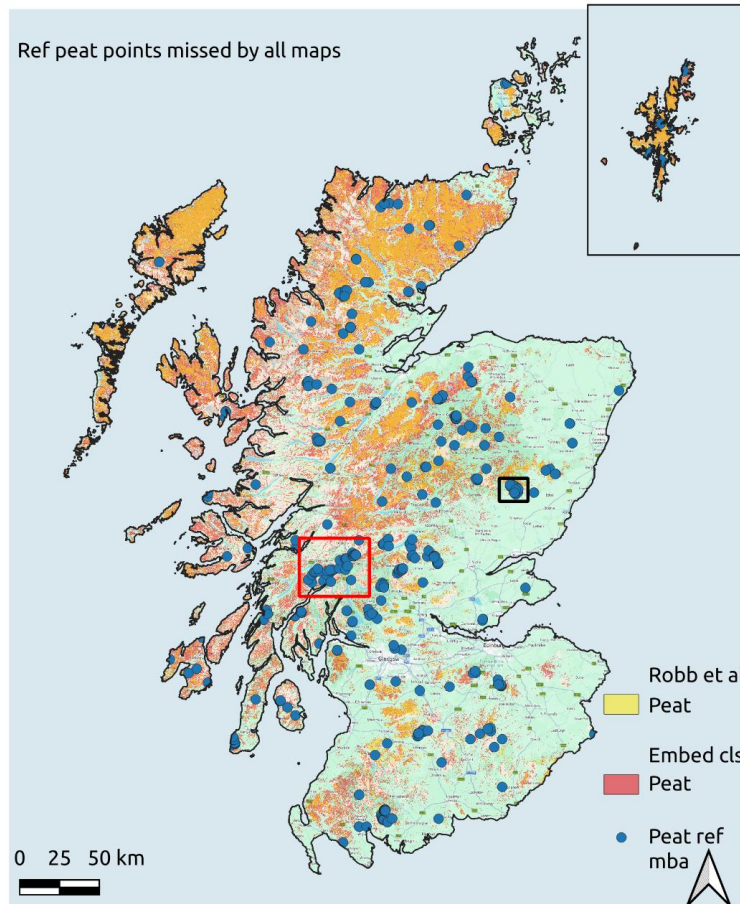
Mapping of peat using hybrid models has been trialled. Hybrid maps reduce errors of omission and have similar errors of commission (~16-20%). Notable improvements include fewer areas of peatlands are missed.

Maps generated using AI also show promise. In this map, the peat extent and depth are estimated using a regression approach derived using Google's Alpha Earth embeddings. These AI generated embeddings are extracted from Google's Earth Engine platform, the results on the left have promise for improving the determination of the extent of Scottish peatlands.

Models have limits

Even the best models have limits. The JHI team identified areas with known peat that are not captured by any of the models. The characteristics of these locations is being examined to determine their common characteristics.

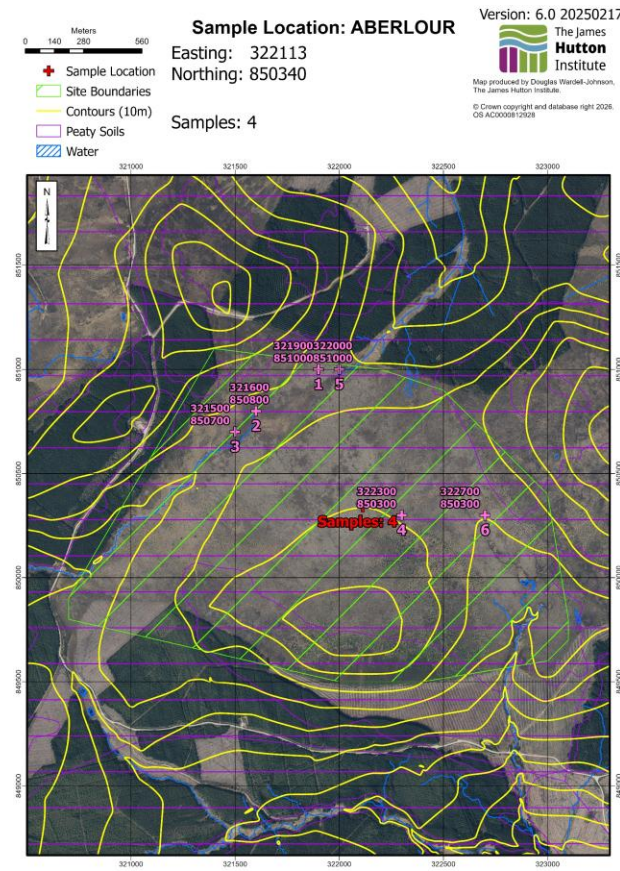
Notable clusters occur near Ben Lui/Strath Fillan (red inset), Trossachs (SE of red inset), Glen Clova hills (black inset), Cairnsmore of Fleet NNR (Galloway) and Loch an Daimh (Wester Ross). Some of these areas are candidates for on-ground sampling this year.



New on-ground sampling underway

Field maps were prepared for new field sampling locations, with eight having been visited before the end of March. For each site, 2-6 potential sampling locations are identified. Depending on the areal estimates of peatland within a site, the field team collects 2-6 samples of peat (cores), depending on whether the site is assessed to be small (2 cores), medium (4 cores) or large (6 cores). When on site, the field team assess the suitability of the individual ranked locations for sampling using their professional judgement.

When peat is cored at a sampling location, carbon samples are obtained at fixed depth intervals (0-20, 20-30, 30-40, 40-50 and 50-60). In addition to the peat cores, peat depths around the cored locations are also estimated using peat rods. Photographs of the soil sample are also collected, and the Hutton team determine which specific type of peatland best describes the location.



Thank you

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