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Introduction to Peat Condition Mapping

Peatlands are a vital natural asset, and TAiM is helping to protect them.

Peat covers approximately 20% of Scotland and is a vital natural asset that provides carbon storage, water filtration and buffering, flood risk mitigation and biodiversity support. However, over 80% of Scotland's soils are degraded in one way or another, reducing their effectiveness and making them vulnerable to climate change and erosion.

A national program of peatland restoration is underway (Peatland Action), which requires details on where peat exists, and what condition it is in. Ground-based survey across the whole of Scotland would be prohibitively expensive, and so a team at the James Hutton Institute has developed an AI-based approach to mapping features that allow us to identify the diagnostic condition of peat across the country. This approach integrates a large number of datasets and includes automate remote sensing interpretation to identify and map erosion and drainage features in peat. It is vital that we understand how accurate this mapping is, and the work in the TAIM project has achieved a lot in enabling us to evaluate and communicate peatland condition mapping accuracy and uncertainty to stakeholders including the Scottish Government and NatureScot.

The drainage and erosion mapping work utilises Computer Vision Machine Learning (CVML) techniques to detect peatland degradation in high resolution aerial images. There are three main sources of uncertainty in such approaches: uncertainty within the annotated training data, within the CVML model(s) themselves, and in the produced AI-based predictions. While the data collection and annotation were largely based on where ground surveys had been conducted, additional annotations were produced where needed, increasing the generalisation of the approach when scaling to national level.

The model uncertainty itself can be tracked using multiple metrics when working with ground truth data, and only models that provide adequate solutions to the problem are considered. Finally, the uncertainty in the produced national-level outputs, while possibly the most difficult to quantify, can be validated against alternative approaches or existing data to determine a level of confidence and trust in the outputs. In the map below, areas that are identified as bare/eroding or with 'drained' subcategories were identified as having erosion features or drainage channels, respectively.

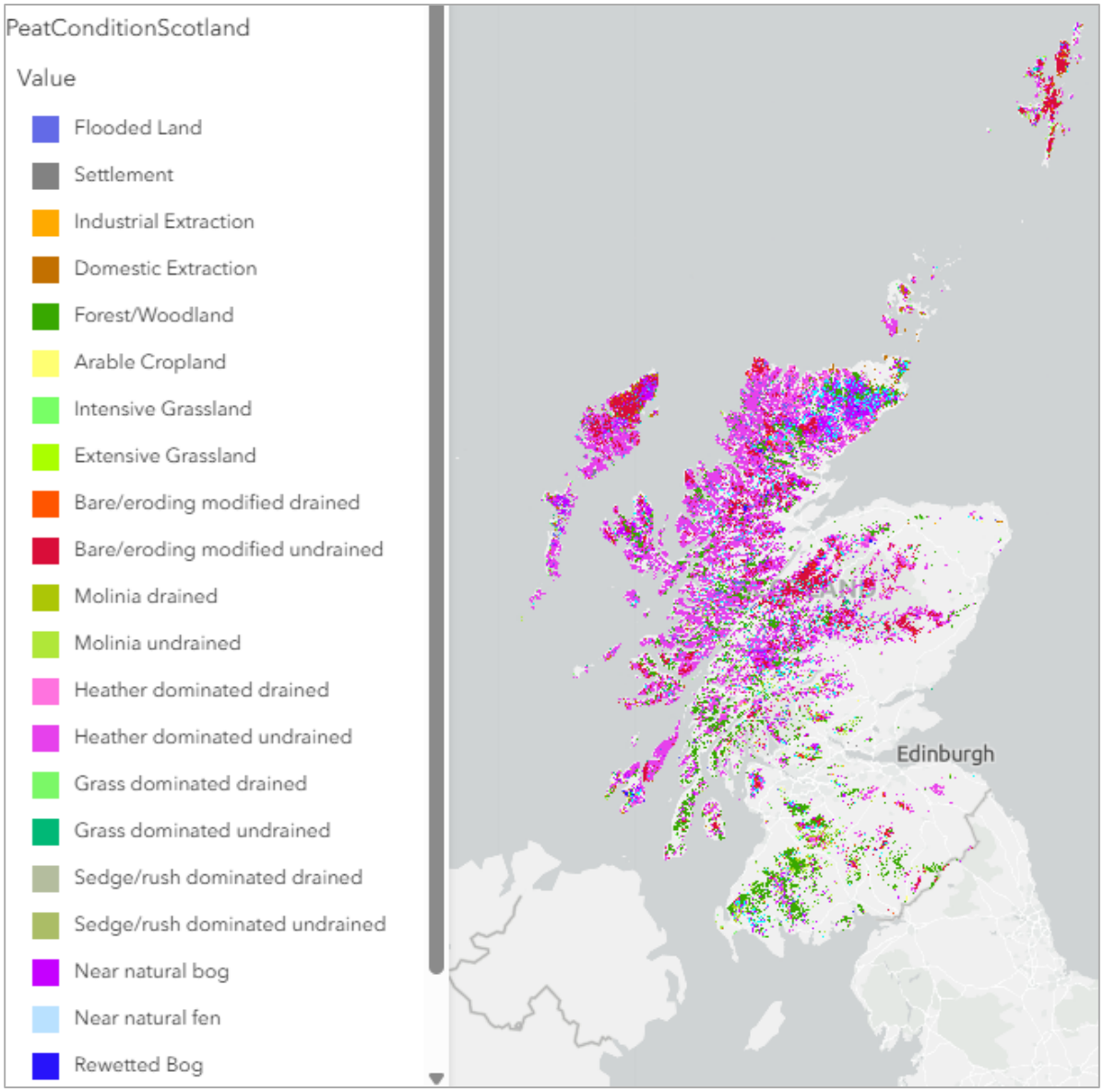

Figure 1: Peat condition map of Scotland