NCEA
Natural Capital and Ecosystem Assessment

England Peat Map User Guide

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NATURAL ENGLAND

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Introduction

This is the user guide for the England Peat Map (EPM), part of the Defra Natural Capital and Ecosystem Assessment (NCEA) Programme. It describes the different outputs that make up the EPM and how these should be interpreted.

These outputs have been created using machine and deep learning modelling techniques. They combine Earth Observation and other data available at the national scale with extensive field survey observations to make predictions about the location, quantity and condition of peat in England. For more information of the technical aspects of the project, see *England Peat Map Project Final Report (NERR149)*.

Outputs

Overview

The EPM outputs are a collection of digital map layers produced by computer models. The models predict the location of different aspects of peatland environments. These are:

- Peaty soil
    - Extent
    - Extent probability
    - Depth
    - Depth confidence
- Vegetation and land cover on peaty soil
    - Vegetation and land cover
    - Vegetation and land cover probability
- Upland peat erosion and drainage
    - Gullies
    - Grips
    - Haggs
    - Bare peat

Peaty soil

Extent and extent probability

We define peaty soil as any soil with an organic content of 20 percent or more and a thickness of at least 10 cm. Our maps are made using a model which calculates the probability that peaty soil is present for each 10 m by 10 m square in England. This includes peaty soil that is covered by up to 1 m of other types of soil. Where the probability is 40 percent or greater, we expect peaty soil to be present. Where it is lower we expect there to be no peaty soil. At the coast the prediction ends at the mean high water mark.

The **peaty soil extent** layer shows only the 10 m squares where we predict peaty soil to be present. The **peaty soil probability** layer shows the probability we have calculated for all squares in England.

All other outputs are constrained to be within the peaty soil extent layer, meaning that we do not show predictions for vegetation and land cover, or upland peat erosion and drainage features outside of the areas we predict to be peaty soil.

Depth and depth confidence

We used a model to calculate the likely depth of peaty soil in all squares included in the peaty soil extent layer, except those covered by water (because it would be difficult to predict depth there). By depth we mean the thickness of the peaty soil layer until it is interrupted by another type of soil or by bedrock. All depths between 0 cm and 10 cm were rounded to 10 cm. We also estimated the average confidence we have in our prediction for each square using a metric called root mean square error (RMSE). This is based on how much existing data there is in the vicinity and how good our model is at predicting that data. We averaged the confidence estimate to 10 km squares due to limitations on the data we can publish.

The **peaty soil depth** layer shows the predicted thickness of peaty soil in each 10 m square where we predict peaty soil to be present. Each square can be clicked to show the prediction. The **depth confidence** layer shows how confident we are in the predicted depth for each 10 km square. A darker colour means higher confidence (lower RMSE).

Vegetation and land cover

The vegetation and land cover map is based broadly on categories related to the land cover hierarchy for UK peatlands, proposed for use by the UK Greenhouse Gas Inventory. The map is provided at 10 m resolution and the vegetation and land cover classes are mapped based on the dominant species within the 10 m pixel. The two primary categories represented in this map are semi-natural fen, characterised by a flow of water into the environment (e.g. from, groundwaters or surface streams) and semi-natural bog, wetland characterised as being rainwater fed. It is important to be aware that the semi-natural fen and bog groups are derived from EPM models, whereas other categories are provided by existing spatial datasets in Defra group. These layers brought in from other maps: Living England and the National Forest Inventory.

Supporting this layer is the vegetation probability layer where each band within the raster file is a different vegetation class the model has predicted within the peaty soil extent.

Table 2 Vegetation and Land Cover Classes

Class	Type	Description
Scrub and tree fen	Semi-natural fen	Woody vegetation occurring in fen environments, e.g. willow (*Salix spp*.).
Short fen vegetation	Semi-natural fen	Below non-woody vegetation occurring in fen environments, ≤50cm in height.
Tall fen vegetation	Semi-natural fen	Non woody vegetation occurring in fen environments, ≥100cm in height e.g. common reed (*Phragmites australis*)
Calluna bog	Semi-natural bog	Bog environments dominated by common heather (*Calluna vulgaris*).
Dry grass and scrub bog	Semi-natural bog	Bog environments dominated by grasses (excluding purple moor grass) or woody vegetation e.g. birch (Betula spp.).
Eriophorum bog	Semi-natural bog	Bog environments dominated by common cotton grass (*Eriophorum spp.).*
Molinia bog	Semi-natural bog	Bog environments dominated by purple moor grass (*Molinia caerulea*.)
Sphagnum dominated bog	Semi-natural bog	Bog environments dominated by *Sphagnum spp*, where *Sphagnum* comprises > 15% foliar aerial cover and > 45% understory cover.
Arable and horticultural	Cropland	Land used for growing crops.
Other grassland	Grassland	Grassland not associated with fen or bog, e.g. pasture.
Bare peat	Semi-natural bog	Areas where unvegetated peaty soil is dominant.
Broadleaved woodland	Woodland	Some coniferous trees may be present but greater than 80% of the area will consist of broadleaved trees.
Conifer woodland	Woodland	Some broadleaved trees may also be present but greater than 80% of the area will consist of conifers.
Built up areas and gardens	Land Cover	Areas identified in Ordnance Survey Master Map as ‘Manmade’, supplemented by additional areas along urban fringes in Ordnance Survey Open Built-Up Areas.
Water	Land Cover	Areas identified in Ordnance Survey Master Map as ‘Water. Areas dominated by open water.

Upland peat erosion and drainage features

There are five different types of upland peatland erosion and drainage feature: grips, gullies, haggs, grip dams and bare peat. They appear on the map as shapes corresponding to their predicted location and dimensions. They can be clicked on to bring up a box showing which type they are, along with some of their predicted dimensions.

Features have been modelled for uplands only and restricted to areas inside the Moorland Line. These features were chosen because they are the most prevalent erosion and drainage features in the uplands and there was a wealth of available field data. Lowland drainage features such as field drains were not mapped as they are often buried and more difficult to detect using image recognition approaches, especially with limited field data. For further information, see *England Peat Map Project Final Report (NERR 149).*

Layer reference tables

This section lists each of the maps and provides brief details about them. Also listed is a summary of the field data used for model training that EPM has been able to publish. For more information on how they were produced, please see the *England Peat Map Project Final Report*.

Modelled layers

Table 2. Summary of modelled layers

Layer name	What it shows	Definitions	Map type
Peaty soil extent	Areas where the likelihood of peaty soil being present is above 40%, at 10 m resolution. The minimum mapping unit, i.e. the smallest area of peat extent mapped, is 300 m^2.	Soils where the organic content is 20 per cent or greater.	Vector
Peaty soil extent probability	Probability of peaty soil occurring across the whole of England at, 10 m resolution.	Soils where the organic content is 20 per cent or greater.	Raster
Peaty soil depth	The predicted depth of peaty soil at 10 m resolution.	Depth of peaty soil that starts within the first metre from the surface. Presented in cm.	Raster
Peaty soil depth confidence	A confidence value for the peaty soil depth prediction at 10 km resolution.	The RMSE of the interpolated prediction averaged to 10 km. Lower	Raster

Layer name	What it shows	Definitions	Map type
		RMSE means higher confidence.	
Vegetation and land cover on peaty soils	The predicted vegetation and land cover class at 10 m resolution.	Presence of each vegetation and land cover class within the peaty soil extent	Vector
Vegetation and land cover on peaty soils probabilities	The probability of each vegetation class at 10 m resolution	As above.	Raster
Upland Peat Erosion and Drainage – Grips	The shape and position of grips mapped at 12.5 cm resolution.	Artificially dug drains within the peaty soil extent above the moorland line.	Vector
Upland Peat Erosion and Drainage – Grip Dams	The shape and position of grip dams at 12.5 cm resolution.	Dams installed to block grips within the peaty soil extent above the moorland line.	Vector
Upland Peat Erosion and Drainage – Gullies	The shape and position of gullies at 12.5 cm resolution.	Headwater fluvial erosion channels within the peaty soil extent above the moorland line.	Vector
Upland Peat Erosion and Drainage – Haggs	The shape and position of peat haggs at 12.5 cm resolution.	Individual steep walls of exposed peat, vegetated on the top and caused by erosion within the peaty soil extent above the moorland line.	Vector
Upland Peat Erosion and Drainage – Bare peat	The shape and position of areas of bare peat at 25 cm resolution.	Unvegetated areas of peat within the peaty soil extent above the moorland line.	Vector

Field Data

These data are the field survey data collected by the England Peat Map project and data contributed by partners and external organisations (collated data). Almost all the data from the field survey are published but only part of the collated data, due to licensing restrictions. The data are further divided by type along the same lines as the layers: peaty soil presence and absence, peaty soil depth, vegetation and surface features. All field survey data have been collected in accordance with the project's own standards. Data from external contributors have largely been supplied in various formats, therefore these have been collated, inputted into the EPM databases and made available for download.

Table 3. Summary of survey data.

Name	Description
EPM Soil Surveys	Results of the soil surveys carried out by the EPM project. The surveys were carried out on 10 m quadrats and each data point represents an individual quadrat.
EPM Peat Depth Surveys	Results of the soil depth surveys carried out by the EPM project. Also carried out on a 10 m quadrat with each point representing an individual quadrat.
EPM Vegetation Surveys	Results of the vegetation surveys carried out by the EPM project. Also carried out on a 10 m quadrat with each point representing an individual quadrat.
Collated Peaty Soil Presence and Depth Observations	Soil presence and depth observations collated from external stakeholders. One feature per observation point, with peat depth values provided where these exist.
Collated Vegetation Class Observations	Collated and combined vegetation survey data from EPM and non-EPM sources. One feature per quadrat, with class values assigned.
Collated Upland Peat Erosion and Drainage Lines	Linear features collated from stakeholders.
Collated Upland Peat Erosion and Drainage Polygons	Polygon features collated from stakeholders.

Interpretation

The Modelling Process

Modelling uses data collected in the field to make predictions over a wider area and enables nationwide maps to be created even for areas where no survey has taken place. The modelling process compares field observations with a variety of national environmental datasets and quantifies the relationships between them. Those environmental factors with the strongest relationship to peaty soil, vegetation and surface features are identified and then used to create a model for the whole country. Some of the survey data is held back from this process and used to check how accurate model predictions are.

Environmental factors that have a strong relationship with the survey data are referred to as predictors and are selected for use in the modelling process. The predictors are combined via modelling and used to create predictions for the whole country, which appear as EPM output layers. The final layers are therefore not solely based on field

survey data or satellite data alone, but rather on the relationship between environmental predictors and field survey data.

Accuracy, Confidence and Uncertainty

In making peaty soil depth predictions, accuracy is limited by a number of factors. One of the most important of these is the quantity and quality of field survey data available. In areas where there is a lot more field data available, we are more confident in the model's ability to predict depth accurately. The depth confidence layer demonstrates this by plotting the RMSE (a measure of the average variance between values predicted by the model and values recorded in the field) which is given in centimetres. The smaller the value the higher our confidence in the depth estimate. In areas where there is a high density of field data points, the RMSE is lower and we are more confident that the depth predictions are accurate. The RMSE is calculated on a pixel by pixel basis where we have provided a depth prediction, but it is then averaged to 10 km by 10 km squares to obscure the precise location of some datasets (i.e. where we had permission to use them for modelling, but not to publish the raw data). Due to the averaging, the value of the RMSE is only a guide to the level of confidence in each area.

As with depth, the accuracy of peaty soil extent predictions is likely to be affected by the availability of quality survey data. The peaty soil extent layer is created by selecting those pixels with a probability of peaty soil occurrence greater or equal to 40 percent. Areas that don't include three or more adjacent pixels are then removed, so the minimum size of any area of peaty soil presented by the map is therefore three pixels (300 square metres). A gauge of how likely peaty soil is to occur is provided by the extent probability layer which presents the probability of occurrence for every pixel in England. This can be used to infer the uncertainty of the prediction where probabilities closer to 40 percent (0.4) carry less certainty and probabilities closer to 100 percent (1) are more certain.

The predictions for each vegetation and land use class are presented alongside a probability of occurrence in the Vegetation and Land Cover Probability Layer. This layer indicates the likelihood of each vegetation and land cover class occurring at every pixel within the extent layer. As a result, it provides insight into the uncertainty of the predictions. Areas where the assigned class has a lower probability suggest greater uncertainty about its actual presence.

For information on the accuracy of the upland peatland erosion and drainage layers, see the detailed metrics in the *England Peat Map Project Final Report*.

The Strength of Predictions Across Geographic Scales

Inaccuracies in the model predictions are expected and can take the form of overestimation or underestimation. However, on average these differences mostly cancel each other out, leaving residual errors which we have reported in our accuracy metrics. This means that while an individual prediction (e.g. a single 10 m square) maybe very different to an observation on the ground, the prediction will be closer to the real world as

scale broadens out. With this in mind, the outputs should be seen as giving stronger predictions at broader scales, such as whole regions or counties, and giving weaker predictions at finer scales such as individual sites.

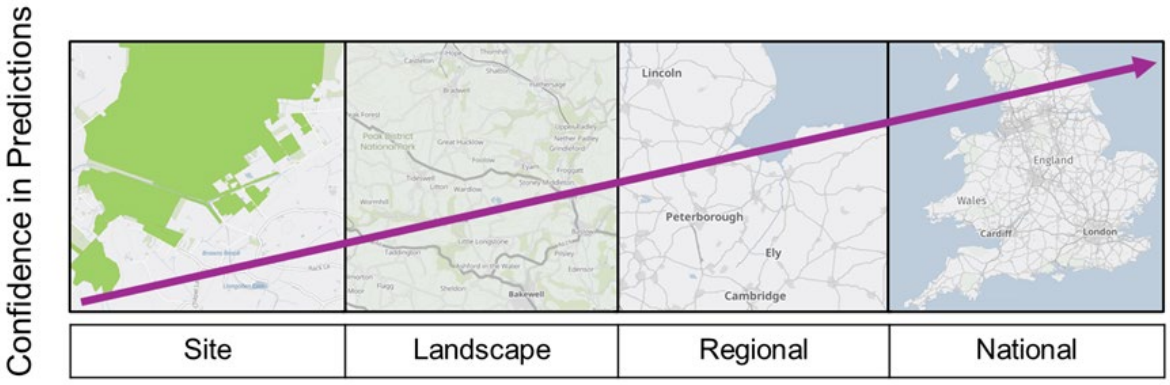

Figure 1 Confidence in the EPM outputs increases with geographic scale. Contains OS data © Crown Copyright and database right 2025. Contains data from OS Zoomstack.

In addition, predictions for extent and depth are weaker in in lowland areas compared to upland areas. This is largely due to a lack of peat thickness observation data in the lowlands. There is also a lack of predictor datasets for the historic land use and human activities that affect peaty soil in these areas. This does not mean that the outputs should be disregarded for specific sites, or in lowland environments, but instead viewed as indicative at this scale. At larger geographic scales they can be used to draw firmer conclusions.

There will be some instances where areas of known peaty soils have not been predicted by the extent model, conversely areas where the extent model has confidently, but wrongly, predicted peaty soil occurrence. Where known peaty soil sites are not predicted, this will normally reflect a lack of survey data for these areas and is something which we aim to address in a future update.

EPM Outputs: Copyright and Licensing

The England Peat Map outputs, including the modelled outputs survey data and collated data are published using the Open Government Licence. This licence allows people to use the maps and field survey data for anything that they want to, as long as they attribute it to the correct person or organisation. More information can be found here How to access Natural England's maps and data - GOV.UK.

For the modelled outputs, EPM survey data and collated data that Natural England owns, the correct copyright statement to use is:

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Natural England is here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.

Further Information

This report can be downloaded from the Natural England Access to Evidence Catalogue. For information on Natural England publications or if you require an alternative format, please contact the Natural England Enquiry Service on 0300 060 3900 or email enquiries@naturalengland.org.uk.

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