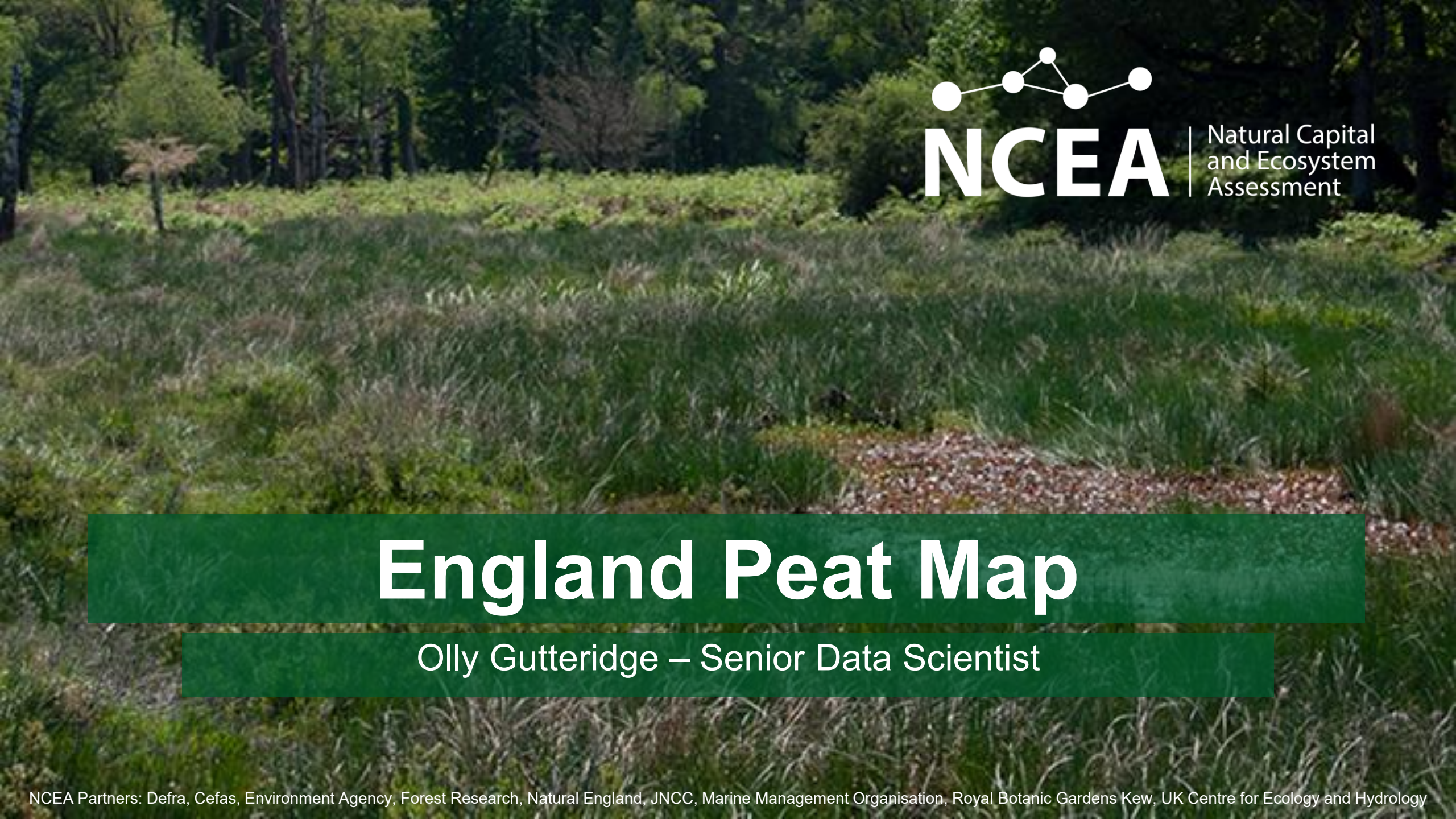

NCEA | Natural Capital and Ecosystem Assessment

England Peat Map

Olly Gutteridge – Senior Data Scientist

NCEA Partners: Defra, Cefas, Environment Agency, Forest Research, Natural England, JNCC, Marine Management Organisation, Royal Botanic Gardens Kew, UK Centre for Ecology and Hydrology

England Peat Map

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What?

- ML derived national maps describing Englands peaty soil extent, depth and vegetation

Why?

- Replace fragmented and inconsistent legacy peat datasets
- Provide single, openly available national evidence base to support ecological reporting and policy

Outputs

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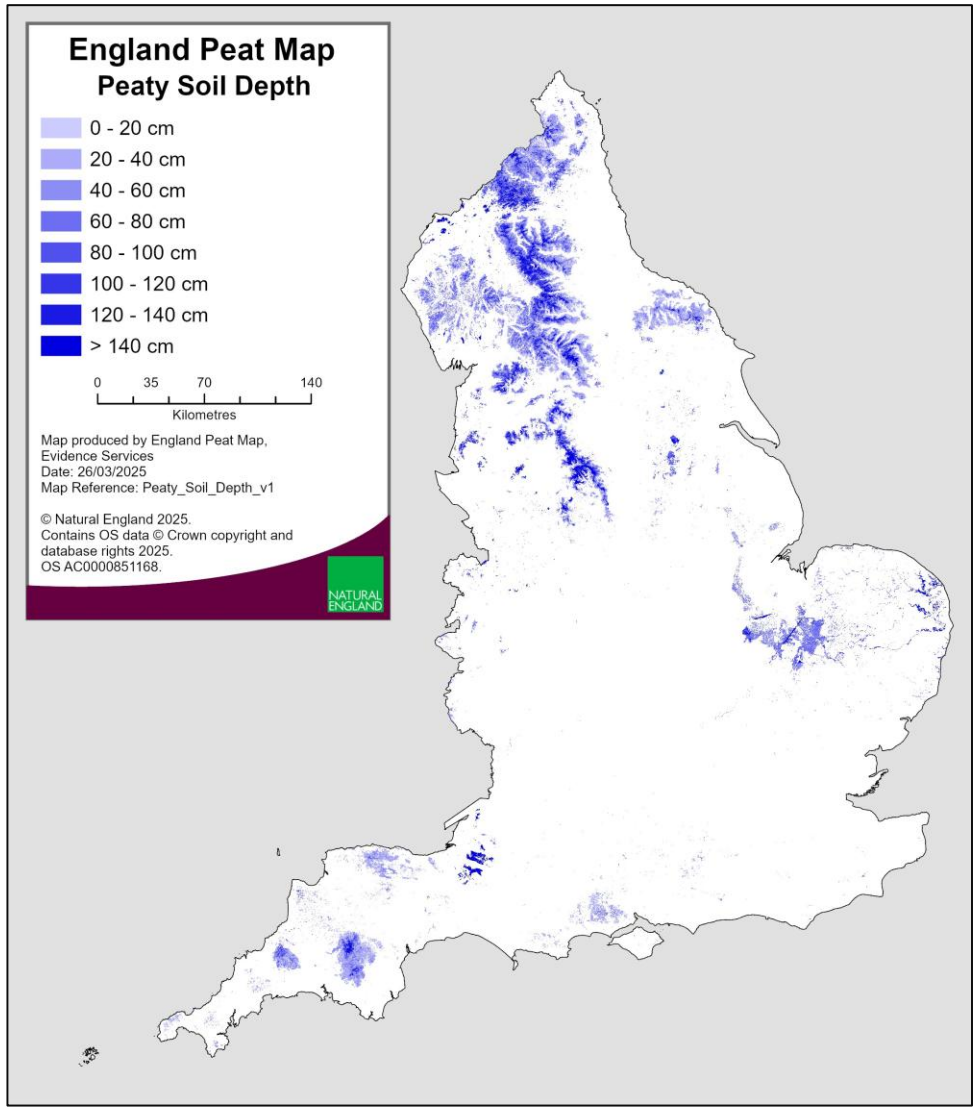

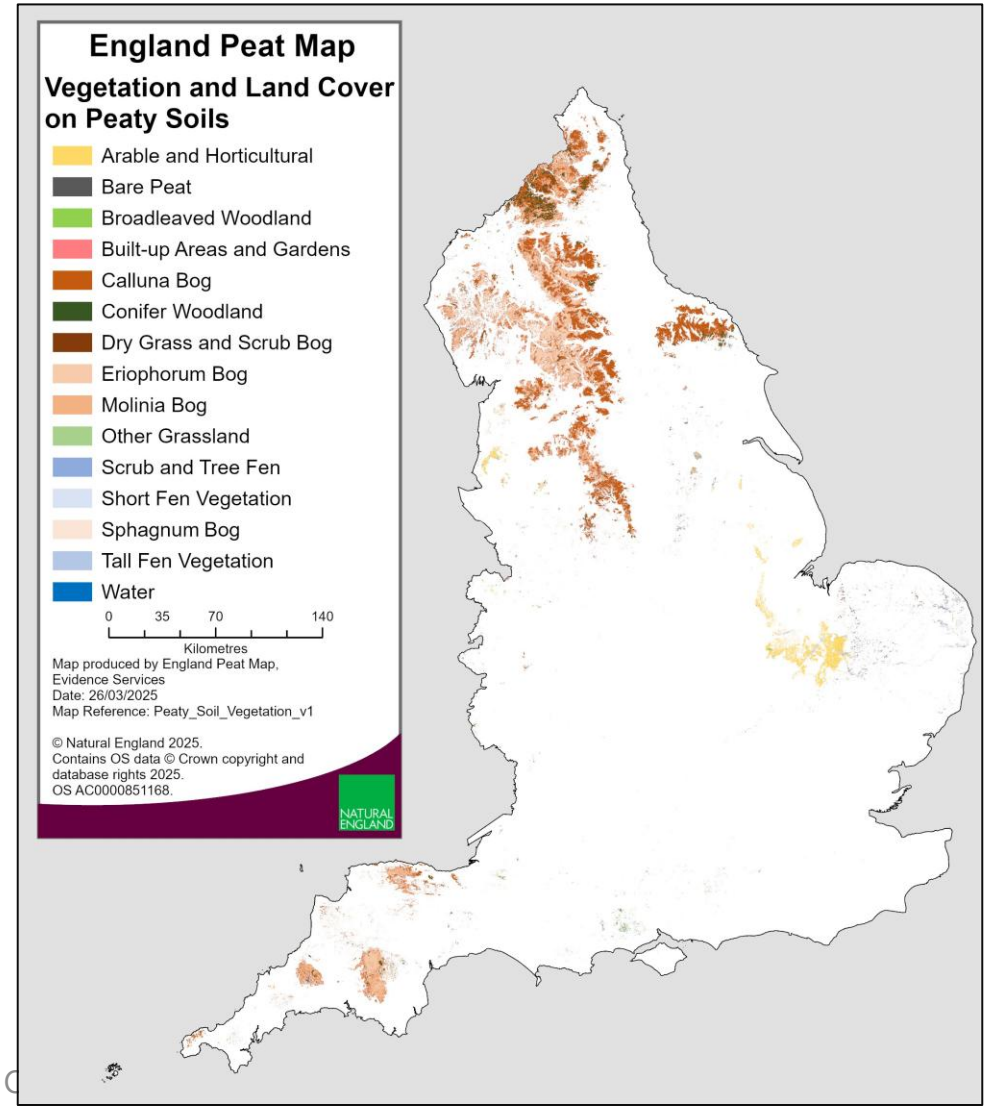

Ground Truth Data

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- Large scale, multi-source training dataset
  - Collated datasets from partners and restoration projects
  - Targeted field survey

- Field survey
  - Designed to target evidence gaps and key peatland areas
  - Stratified across 13 Biogeographic Zones across England
  - Survey points aligned to Sentinel-2 data for utility in EO applications

Covariate Data

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Covariate	Source	Extent	Depth	Vegetation	Bare Peat
Sentinel-1 Backscatter and Coherence	ESA	+	+	+	
Sentinel-2 imagery	ESA	+	+	+	
Sentinel-2 bare soil index	ESA	+	+		
Landsat-8 thermal	NASA	+	+		
LiDAR-derived slope	EA	+	+	+	
LiDAR-derived elevation (DEM), aspect, TWI, TRI and geomorphons	EA	+	+		
LiDAR-derived CHM	EA			+	
Dudley Stamp Land Utilisation Survey	EA	+	+		
Bedrock and superficial geology	BGS	+	+		
Flood risk from tidal and river water (1%) and from surface water (3%)	EA	+	+		
Broad Landscape Type	NE	+	+		
Distance to sea, distance to river	OS	+	+		

Soil data distribution

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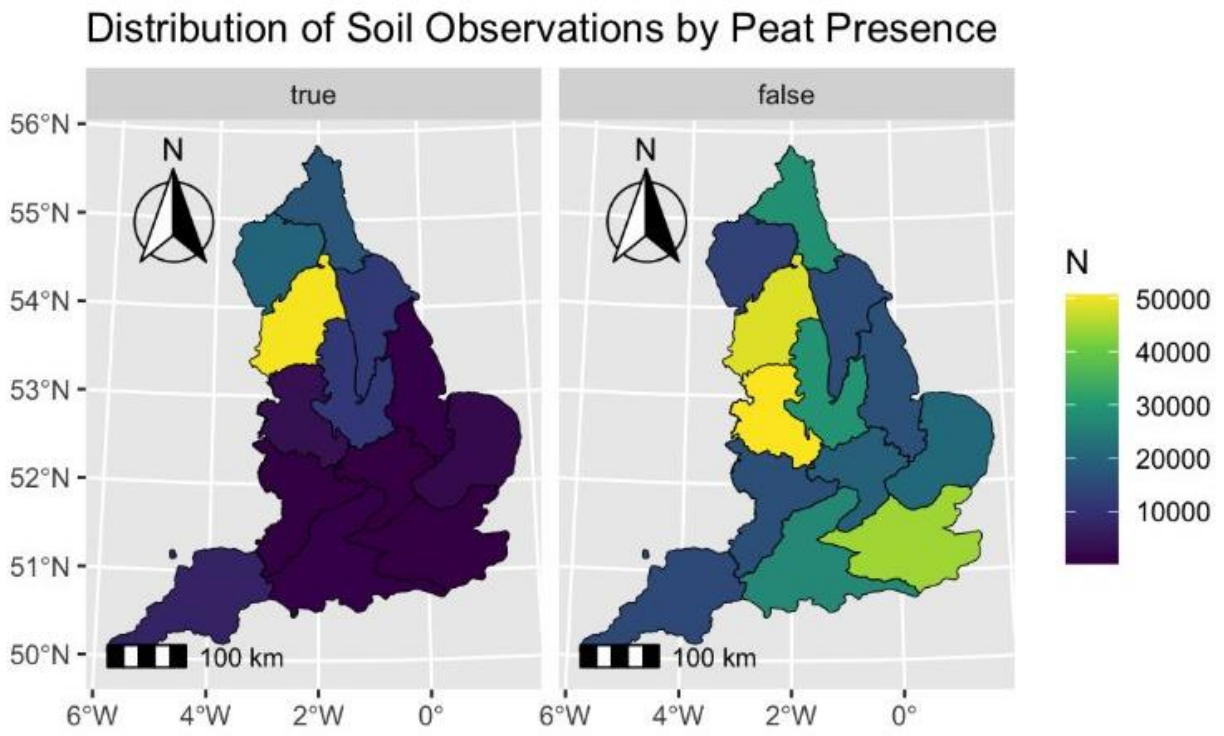
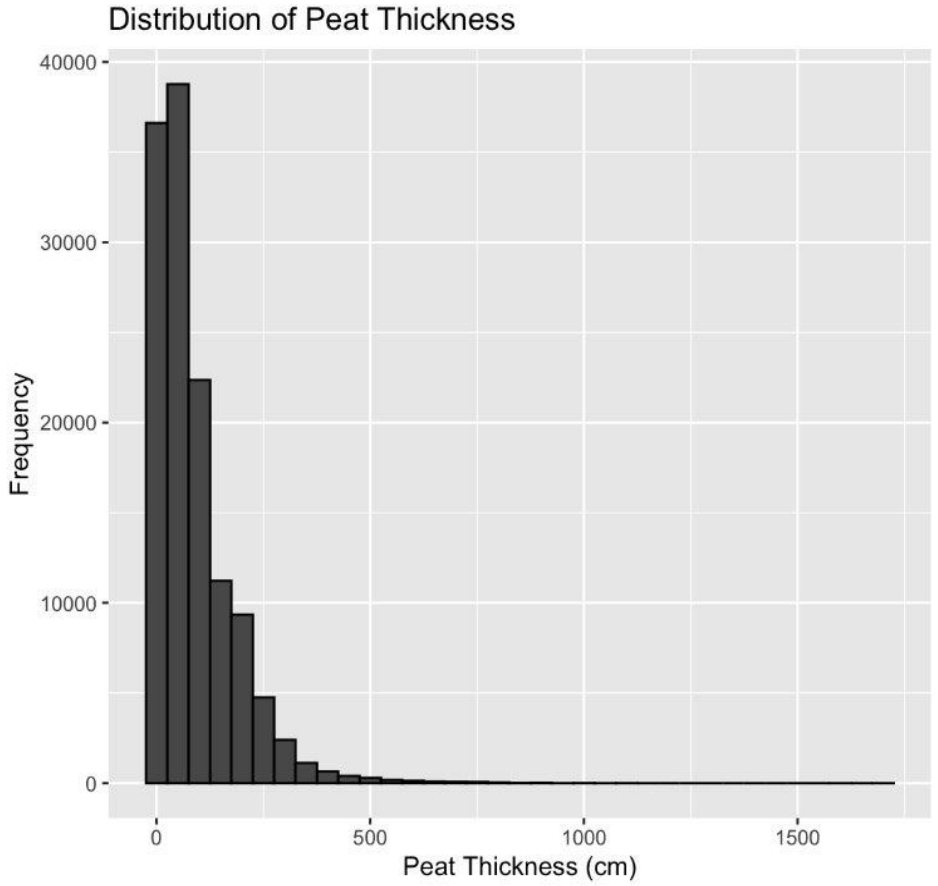
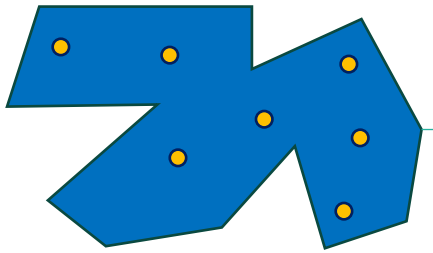
Natural Capital and Ecosystem Assessment



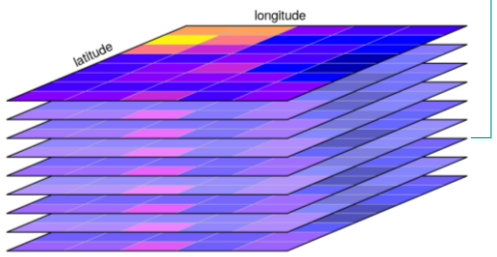


Modelling – Soil

Ground truth data (vector)



Covariate stack (raster)



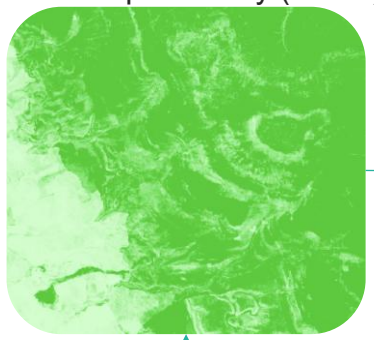
Data Preparation

Preprocessing

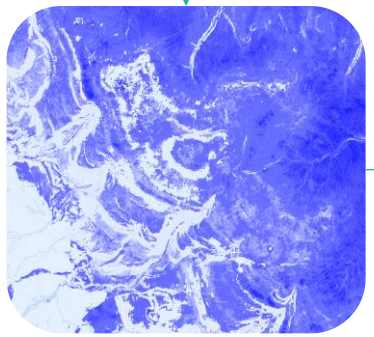
XGBoost

Predict

Extent probability (raster)



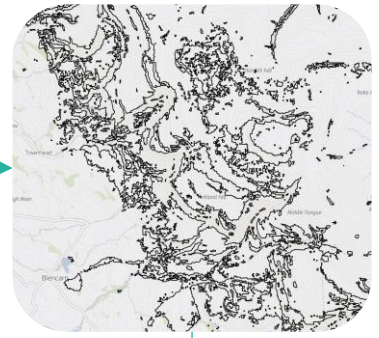
Depth prediction (raster)



Threshold, Vectorise and Post Process

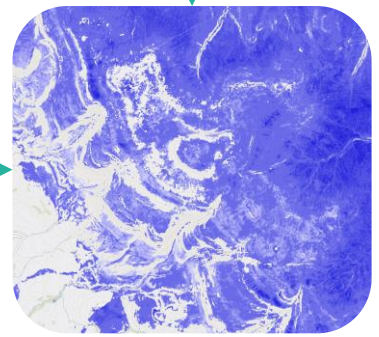
Ordinary Kriging

Extent (vector)



Crop

Depth interpolated (raster)



Results - Extent

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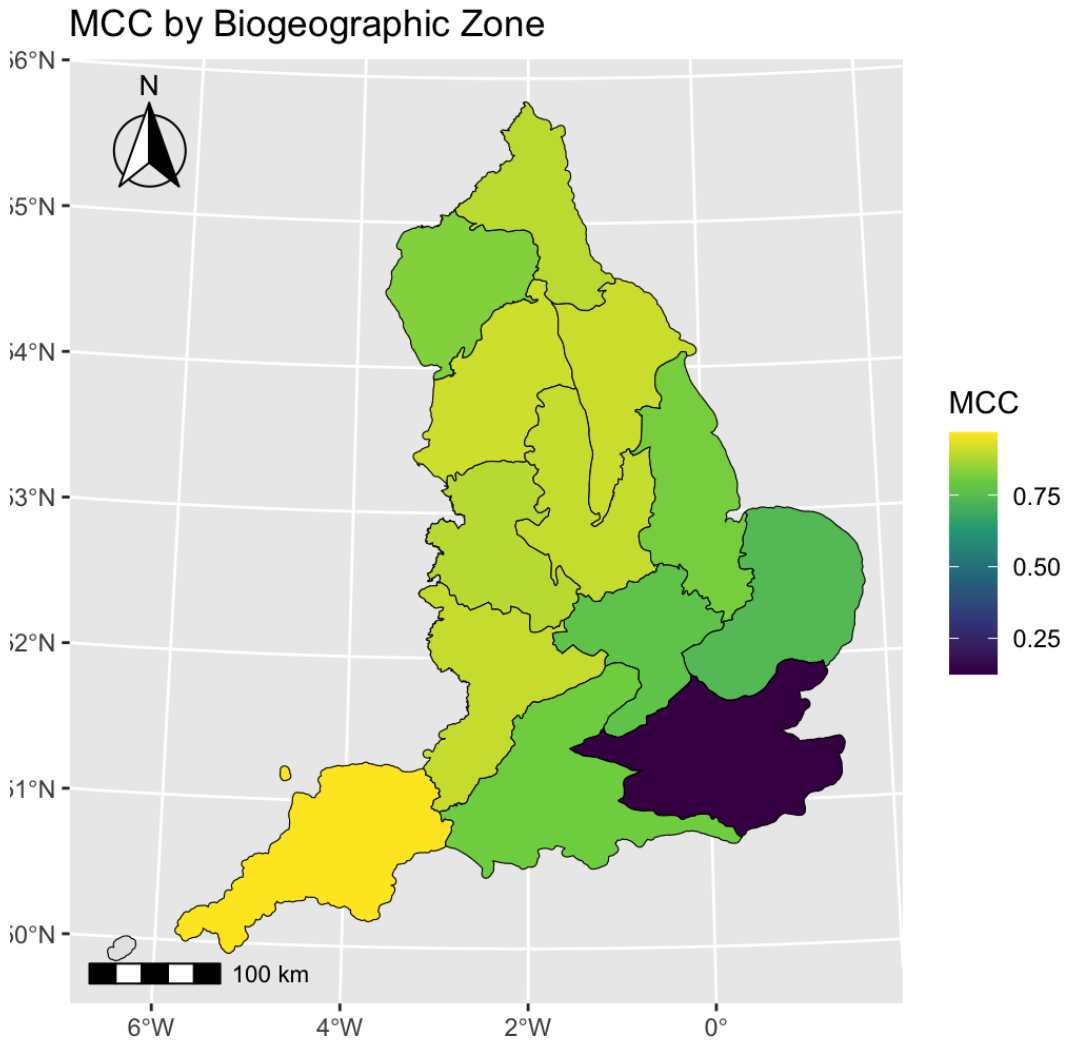
- Overall MCC of ~0.9 shows high classification ability
- MCC greatly varies across the country
  - Driven mainly by the availability of training data
  - Areas with very little peat have a lower MCC – the model is more conservative

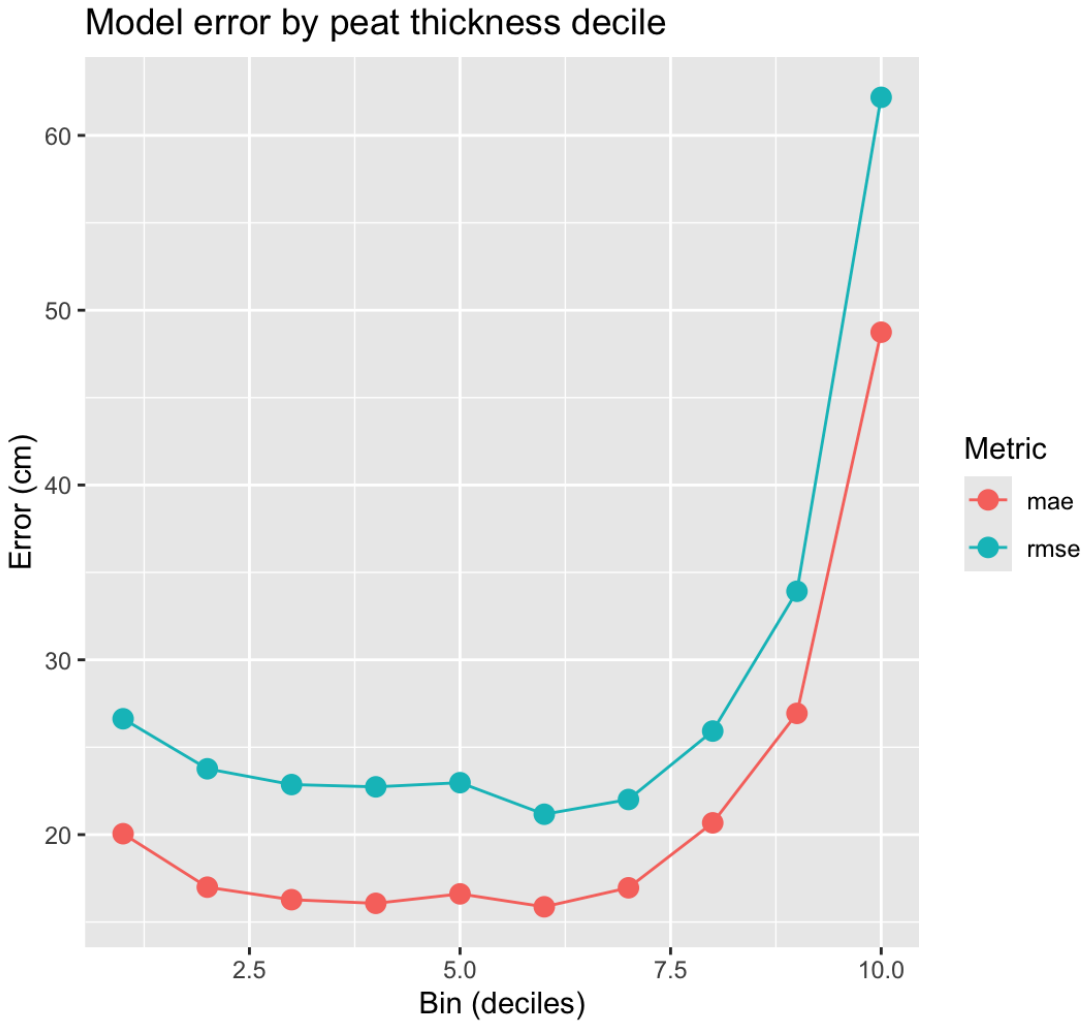
Overall Accuracy	F1 Score	MCC	Sensitivity	Specificity
0.954	0.913	0.885	0.964	0.951



Results - Depth

- Interpolation improved the model error (RMSE, MAE) and its ability to “fit” the ground truth observations (R2)
- Model error increases with peat depth (thickness)

Output	RMSE (cm)	MAE (cm)	Huber Loss	R Squared
Model	67.5	46.0	45.5	0.47
Model + Interpolation	30.9	20.8	20.3	0.91



Vegetation data distribution

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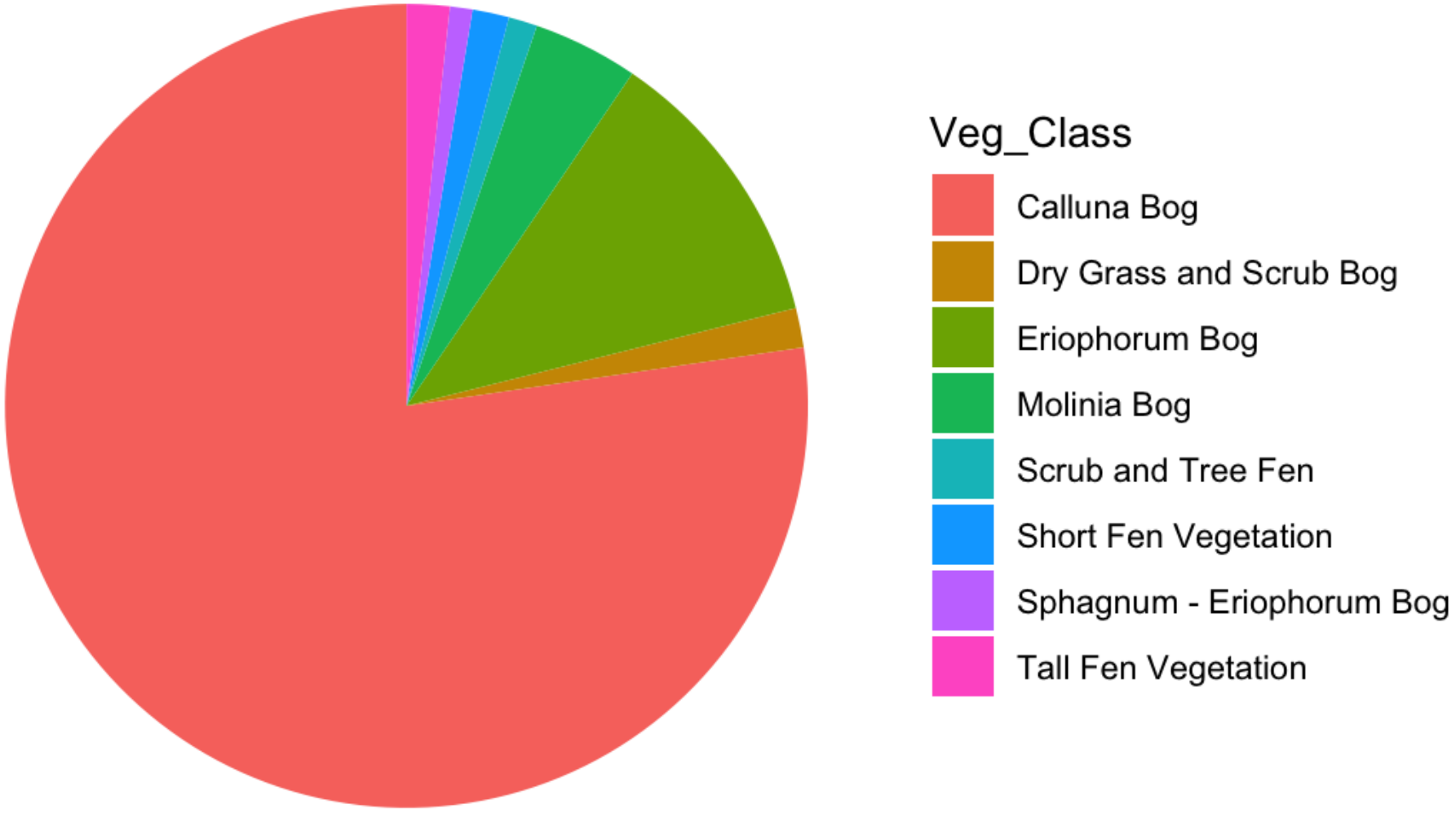

Modelling – Vegetation

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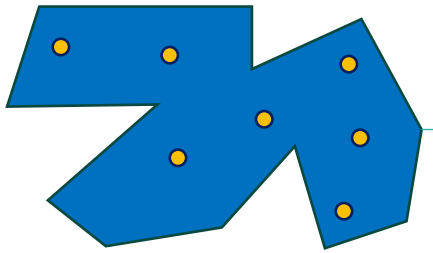
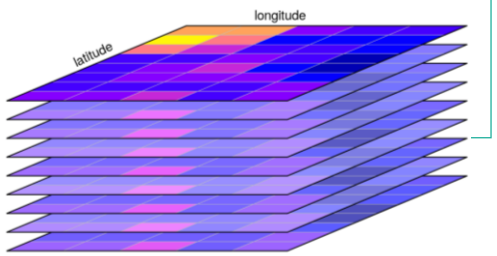
Training data (vector)



Covariate stack (raster)



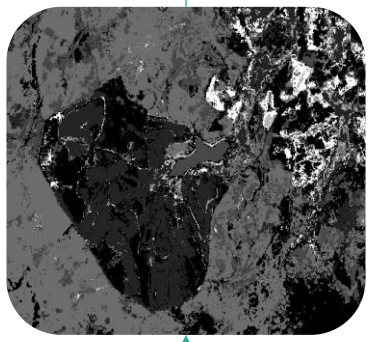
Data Preparation

Preprocessing

XGBoost

Predict

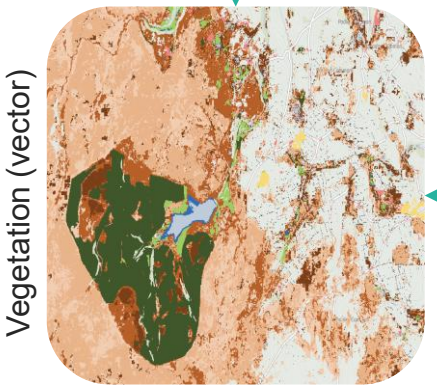
Vegetation (raster)



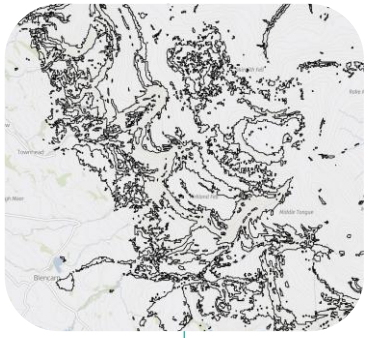
Burn in Ancillary Layers

Vectorise

Vegetation (vector)



Extent (vector)



Crop

Results - Vegetation

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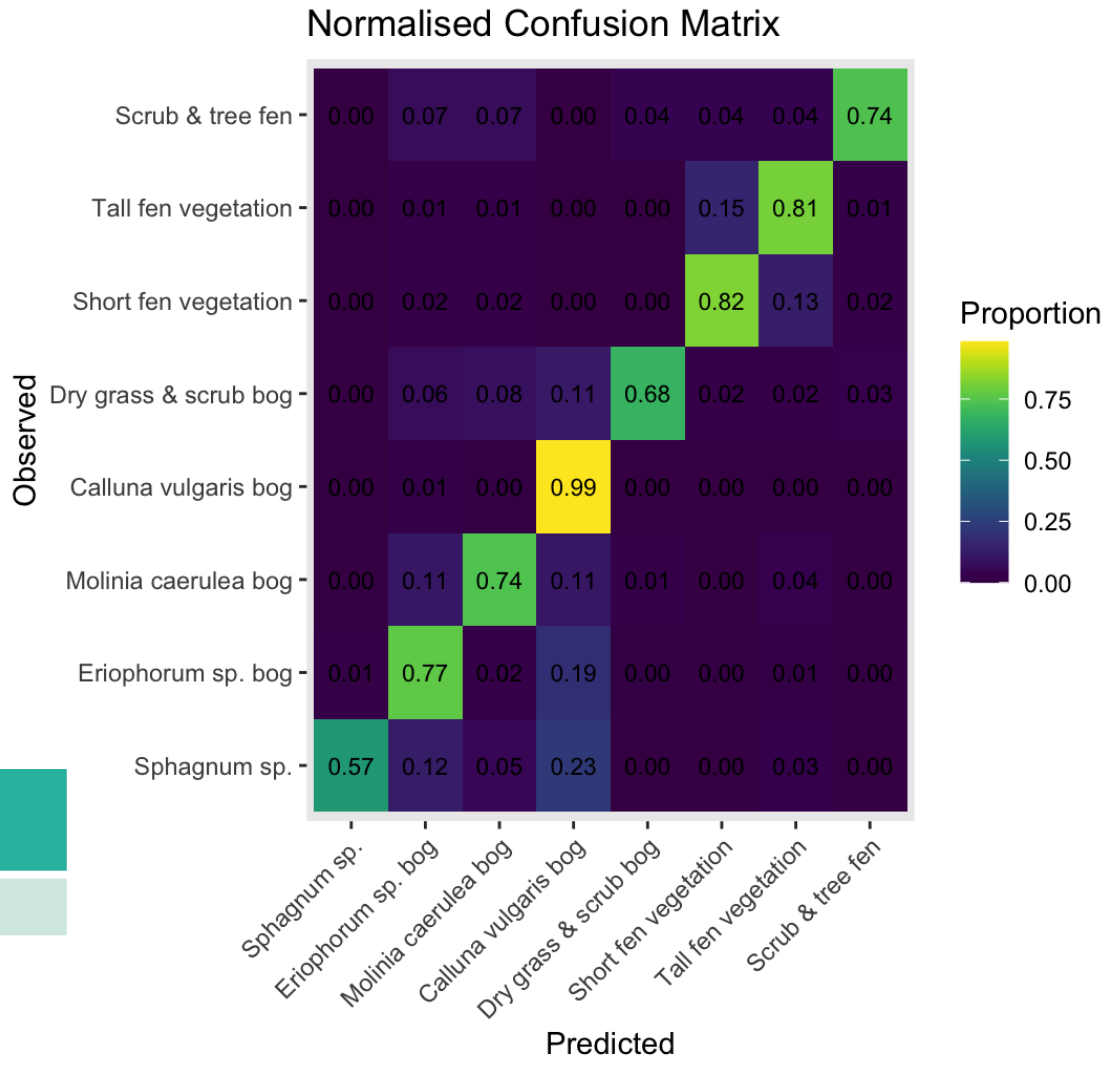
- Calluna most accurately predicted.
  - Most common class in data
- Sphagnum is most often misclassified
  - Confused with Calluna
  - Often understory to other vegetation
- Eriophorum is also confused with Calluna
- Tall fen and short fen are sometimes confused



Overall Accuracy	Kappa	F1 Score	Precision	Recall
0.94	0.82	0.93	0.93	0.94

Next steps

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- New covariates
  - Climate data (precipitation, temperature)
    - Annual composites, historical data
  - NATMAP soils data – Cranfield university
  - Sentinel 2 indices - NDVI, NDWI, NDMI etc.
  - NISAR
- Soil
  - Targeted field survey and data collection in low performing areas
    - Lowland agricultural peatlands
  - Implement better data splitting to cope with high degree of spatial autocorrelation
- Vegetation
  - Targeted field survey for low performing classes
  - Incorporate into peatland condition monitoring and change detection

Links

NCEA
Natural Capital and Ecosystem Assessment

https://england-peat-map-portal-ncea.hub.arcgis.com/

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