

Mapping peatlands, peatland carbon and climate change impacts

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Introduction



- **Context of climate change**
- **Peatlands form a significant carbon store**
- **They may be an active sink (or source)**
- **Role threatened by land use change, climate change, atmospheric inputs**
- **Each country needs to assess its C stock**

Basin peat



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Blanket peat



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Calculation of total carbon stock



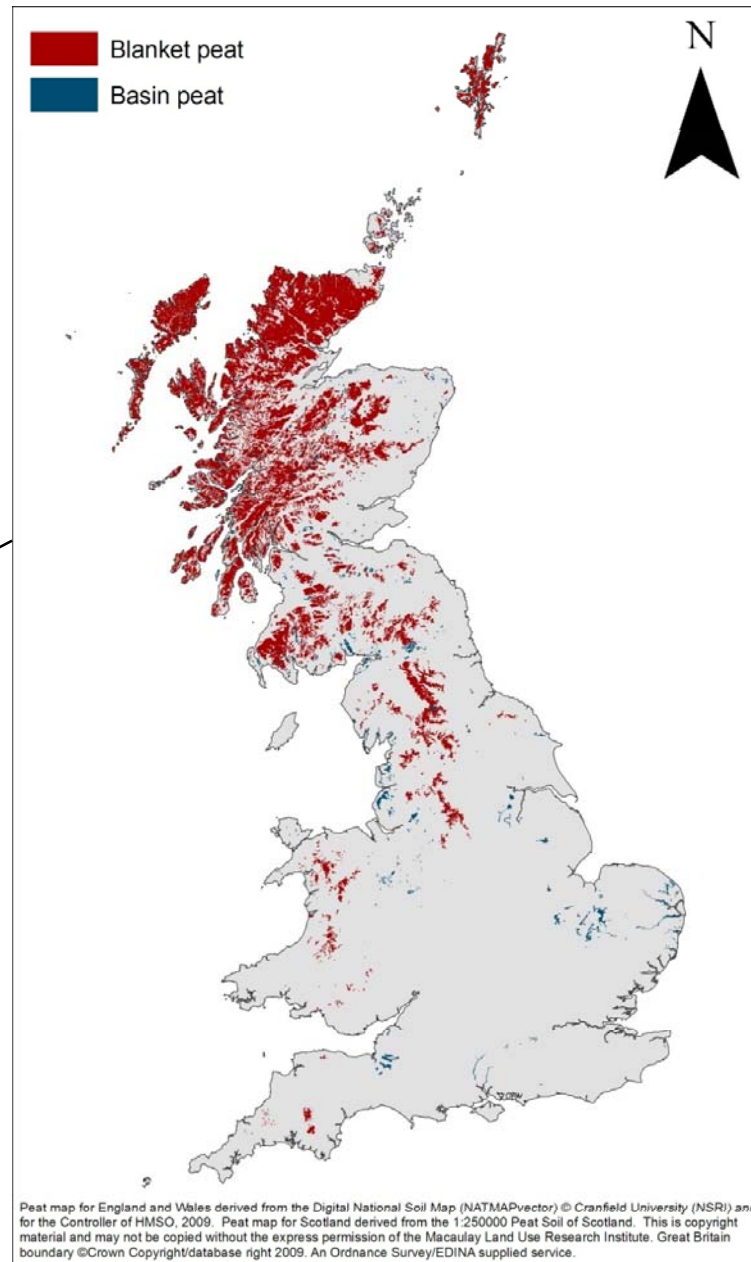
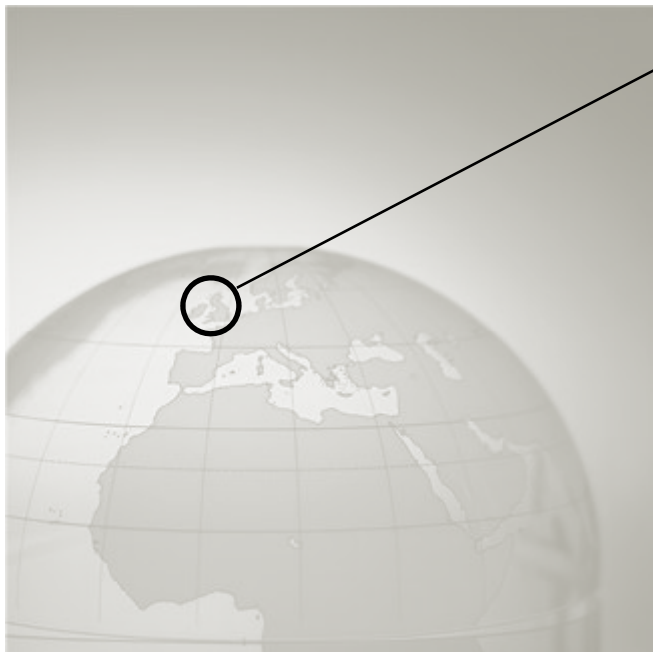
Total carbon stock =

area × depth × dry bulk density × %C

But exist uncertainties in each



The Peatlands of Scotland, England and Wales



Area

- Error on area not easy to define

Area (kha)

Blanket peat	1111 ± 26
Basin peat	73 ± 1
Semi-confined peat	542 ± 36
Peatland total	1727 ± 45



Survey kit

Depthing Rods



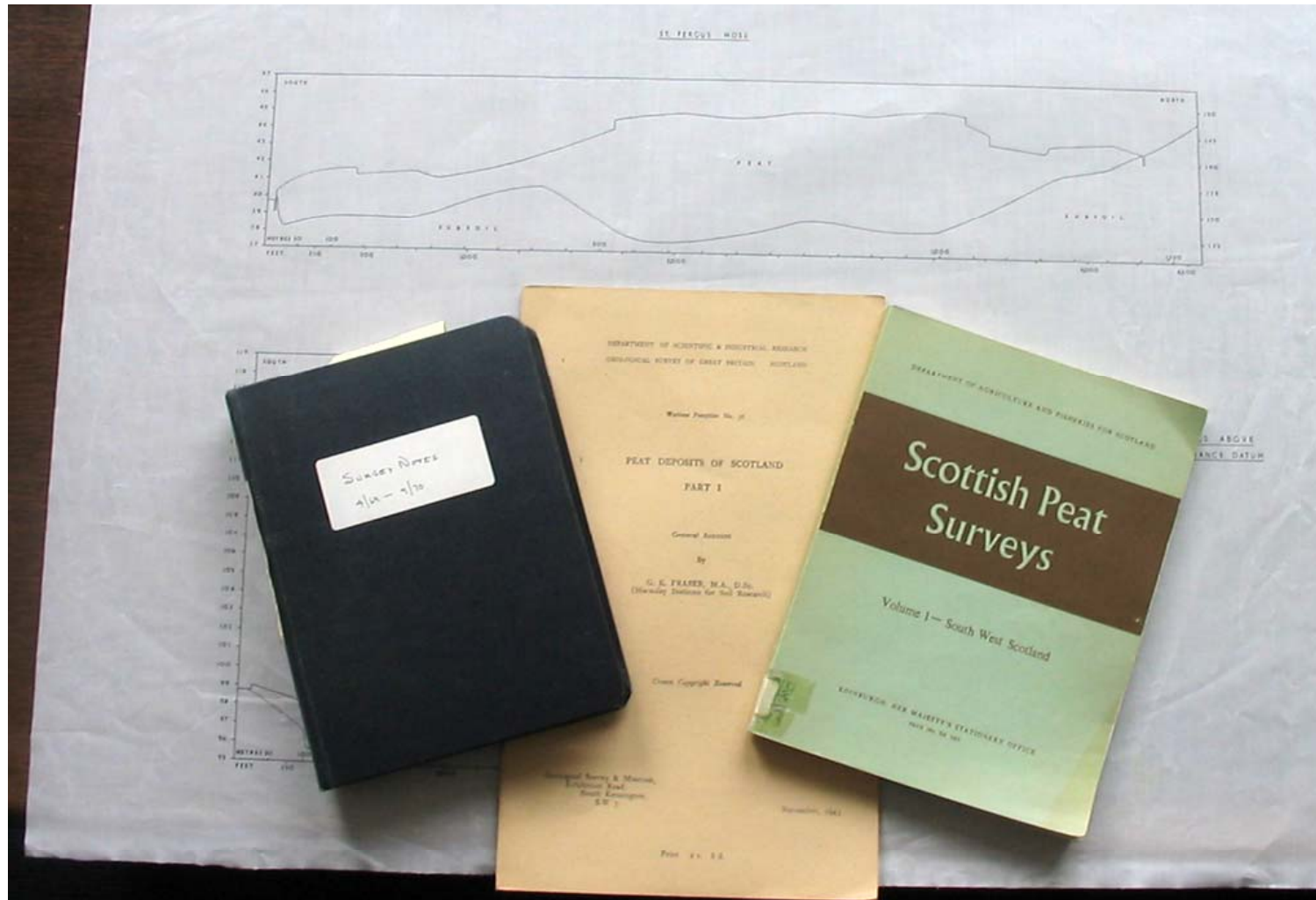
Russian (or Macaulay) Sampler



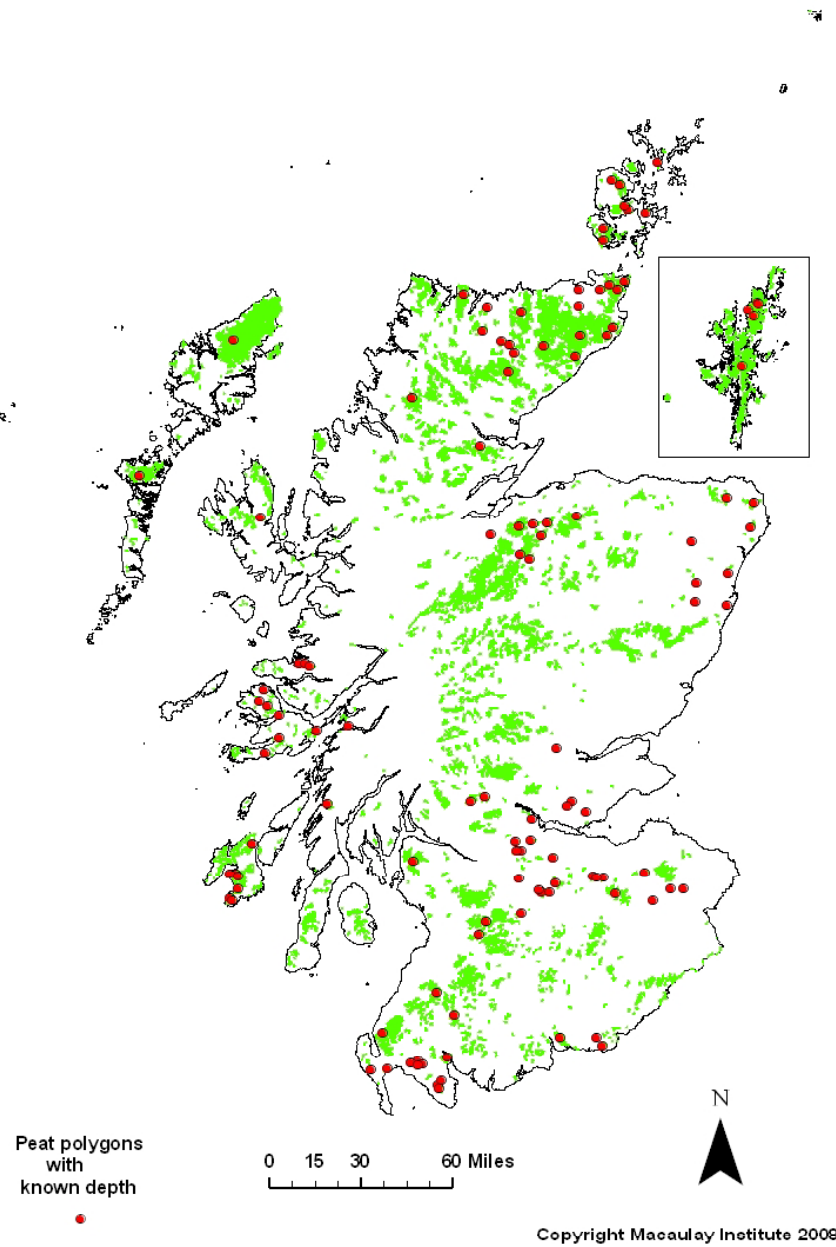
Archived records



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Areas sampled for depth



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Depth



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Peat depth (m)

Peat Type

Basin peat (>0.5 m)

Undifferentiated blanket peat (>0.5 m)

Eroded basin peat (>0.5 m)

Deep blanket peat (>1 m)

Eroded deep blanket peat (>1 m)

Eroded undifferentiated blanket peat (>0.5 m)

**Peat in other map
units**

Blanket peat

Basin peat

Semi-confined peat



Depth



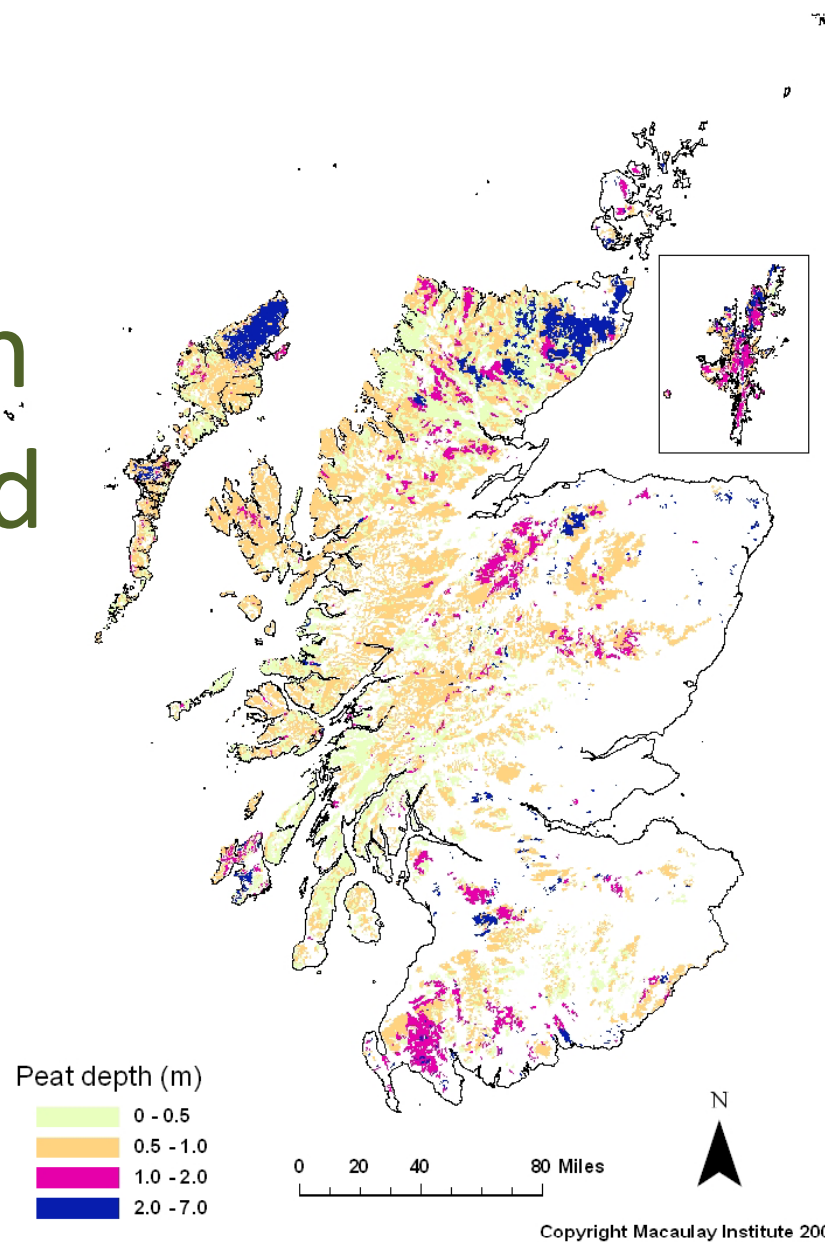
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Peat depth (m)

means \pm standard errors (number of values)

Peat Type		Weighted Average Depth
Basin peat (>0.5 m)		2.87 \pm 0.09 (360)
Undifferentiated blanket peat (>0.5 m)		1.34 \pm 0.10 (652)
Eroded basin peat (>0.5 m)		2.72 \pm 0.39 (4)
Deep blanket peat (>1 m)		2.30 \pm 0.15 (166)
Eroded deep blanket peat (>1 m)		1.70 \pm 0.04 (30)
Eroded undifferentiated blanket peat (>0.5 m)		1.32 \pm 0.08 (116)
Peat in other map units	Blanket peat	1.12 \pm 0.07 (48)
	Basin peat	2.87 \pm 0.34 (8)
	Semi-confined peat	1.28 \pm 0.09 (71)

Peat depth in Scotland



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Dry Bulk density

- Few values
- Not easy to measure

Bulk density (g cm⁻³)

means ± standard errors (number of values)

Depth (m)	0–0.3	0.3–1	> 1
Basin			
peat	0.136 ± 0.022 (12)	0.114 ± 0.017 (17)	0.092 ± 0.004 (16)
Blanket			
peat	0.134 ± 0.009 (17)	0.123 ± 0.004 (34)	0.143 ± 0.010 (8)

Proportion of carbon

- Fairly well defined

Carbon contents (%)

means \pm standard errors (number of values)

Depth (m)	0–0.3	0.3–1	> 1
Basin peat	51.1 \pm 1.0 (25)	48.6 \pm 1.1 (43)	60.8 \pm 3.4 (2)
Blanket peat	50.6 \pm 1.8 (21)	52.9 \pm 0.7 (49)	54.6 \pm 3.2 (7)
Eroded deep blanket peat	50.1 \pm 3.5 (10)	57.1 \pm 0.4 (8)	54.2 \pm 1.2 (2)
Eroded blanket peat	53.0 \pm 0.9 (40)	55.2 \pm 1.0 (33)	54.0 \pm 3.2 (9)

Relative uncertainties

Estimation of errors

Parameter	No. samples	Location	% Error in estimates
Depth	~6000	Country-wide but some areas under-represented	7.2
% C	240	Country-wide but mainly surface (0 – 1 m)	3.4
Bulk density	104	Country-wide but weighted towards NE Scotland and few deep samples (>2 m)	8.3
Area	1455 polygons	Country-wide	4.5

Carbon stock

Estimated carbon stocks (MtC) within Scotland for soils with an organic surface horizon (means \pm SE)

Soil type	C Stock (<100 cm depth)
Blanket peat	737 \pm 19
Basin peat	44 \pm 4
Semi-confined peat	323 \pm 39
Total peat	1104 \pm 44

Carbon stock

Estimated carbon stocks (MtC) within Scotland for soils with an organic surface horizon (means \pm SE)

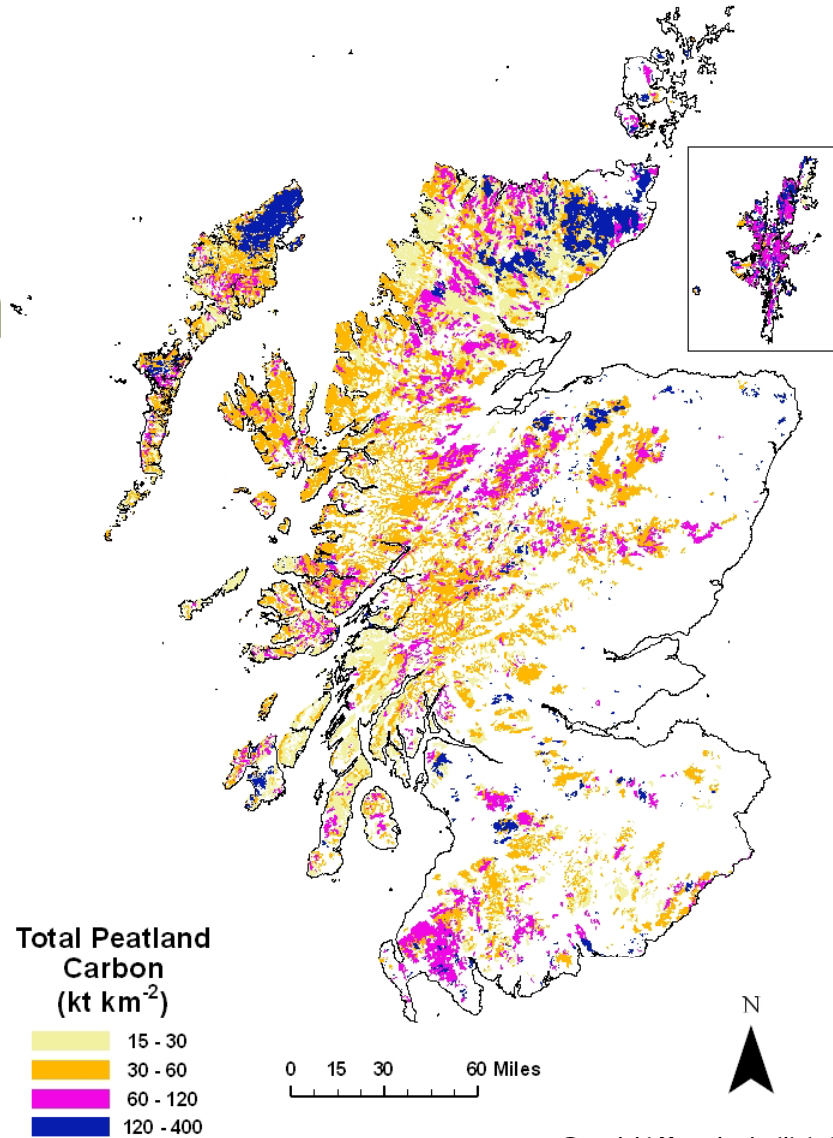
Soil type	C Stock (<100 cm depth)	C Stock (>100 cm depth)
Blanket peat	737 \pm 19	355 \pm 46
Basin peat	44 \pm 4	77 \pm 6
Semi-confined peat	323 \pm 39	85 \pm 28
Total peat	1104 \pm 44	516 \pm 55

Carbon stock

Estimated carbon stocks (MtC) within Scotland for soils with an organic surface horizon (means \pm SE)

Soil type	C Stock (<100 cm depth)	C Stock (>100 cm depth)	Total C Stock
Blanket peat	737 \pm 19	355 \pm 46	1091 \pm 50
Basin peat	44 \pm 4	77 \pm 6	120 \pm 8
Semi-confined peat	323 \pm 39	85 \pm 28	408 \pm 49
Total peat	1104 \pm 44	516 \pm 55	1620 \pm 70

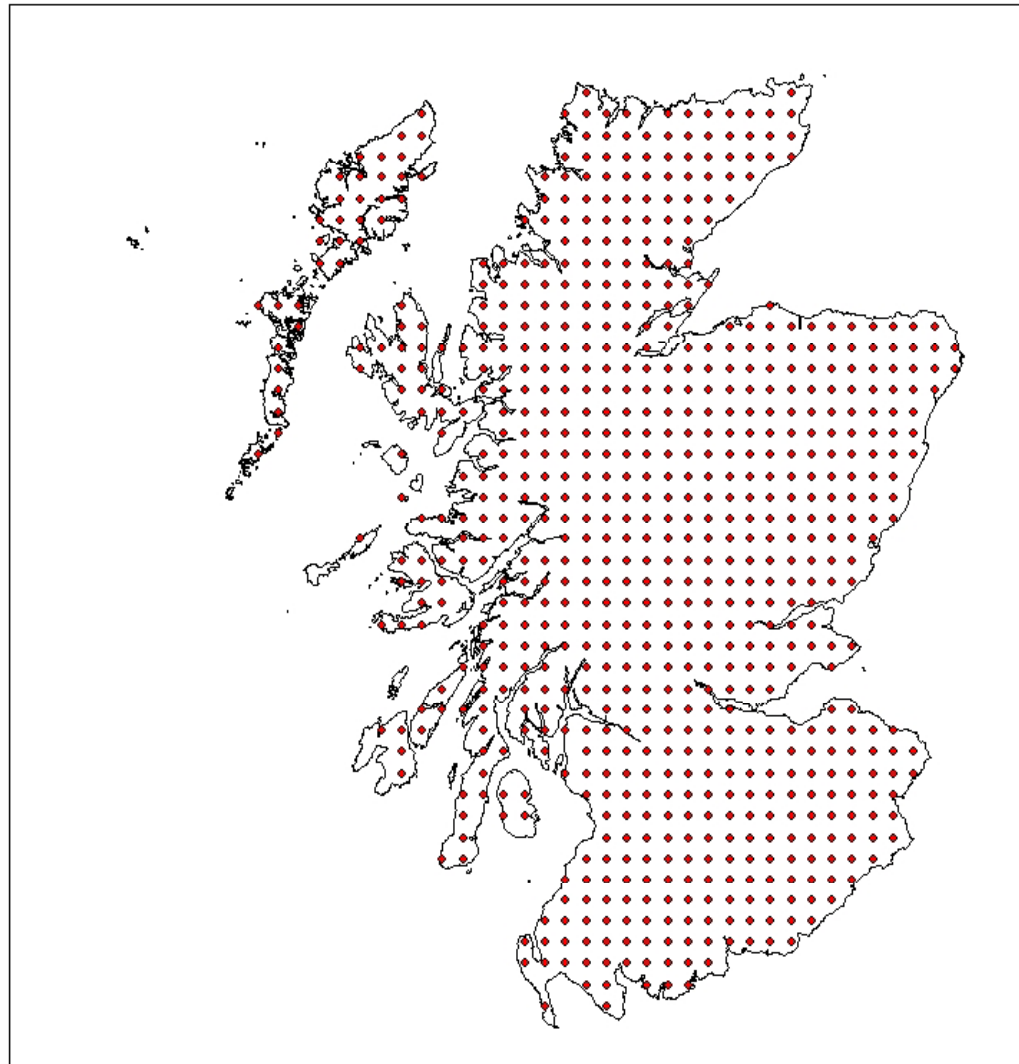
Peatland Carbon density in Scotland



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*Chapman, S.J., Bell, J.,
Donnelly, D., Lilly, A.,
2009. Carbon stocks
in Scottish peatlands.
Soil Use and
Management 25,
105-112.*

NSIS points (10 km spacing)



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NSIS

- **National Soils Inventory for Scotland (NSIS_1)**
- **Select points where peat occurs**
- **Total peatland C stock (to 100 cm) 1166 Mt C**
- **Compares with 1104 Mt C using map units**

Conclusions

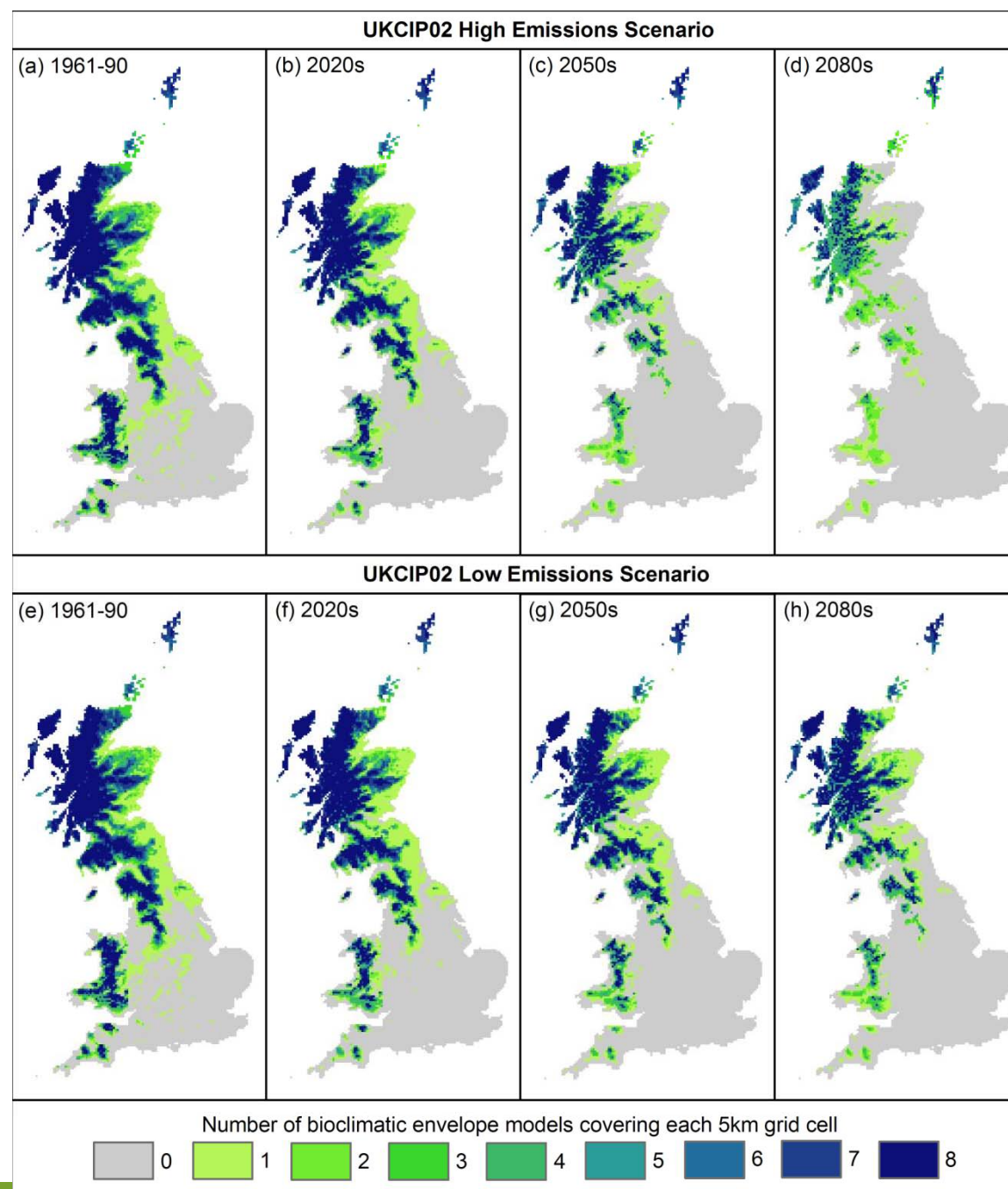
- **We believe we have a better estimate**
- **Some areas of Scotland are still uncertain**
- **We still need better bulk density values**
- **Peatland C stock is 56% of total soil C stock**



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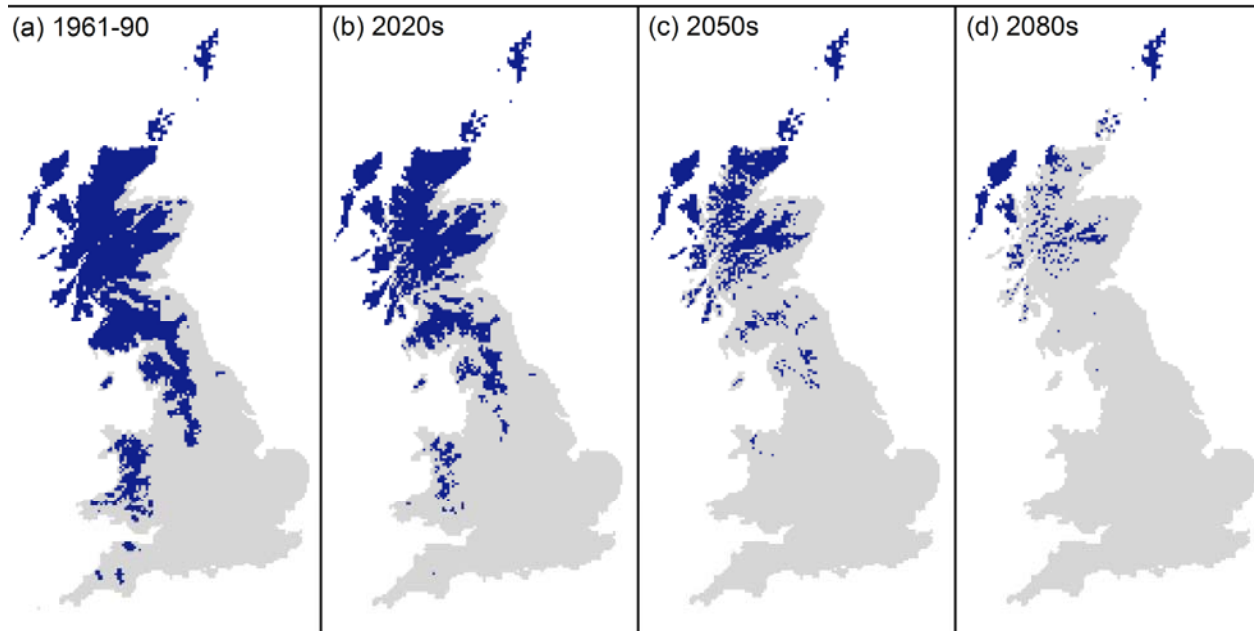
Clark, J., Gallego-Sala, A., V, Allott, T., Chapman, S., Farewell, T., Freeman, C., House, J., I, Orr, H., Prentice, I., Smith, P., 2010. Assessing the vulnerability of blanket peat to climate change using an ensemble of statistical bioclimatic envelope models. Climate Research 45, 131-U462.

Projected changes in bioclimatic space associated with the 1961-90 baseline climate and mapped area of blanket peat using UKCIP02 high and low emissions scenarios. Bioclimatic envelope models used were P50, P65-PT, LM, H-GLM, BBOG, BBOG-TREE, BBOG-GLM, BBOG-GAM

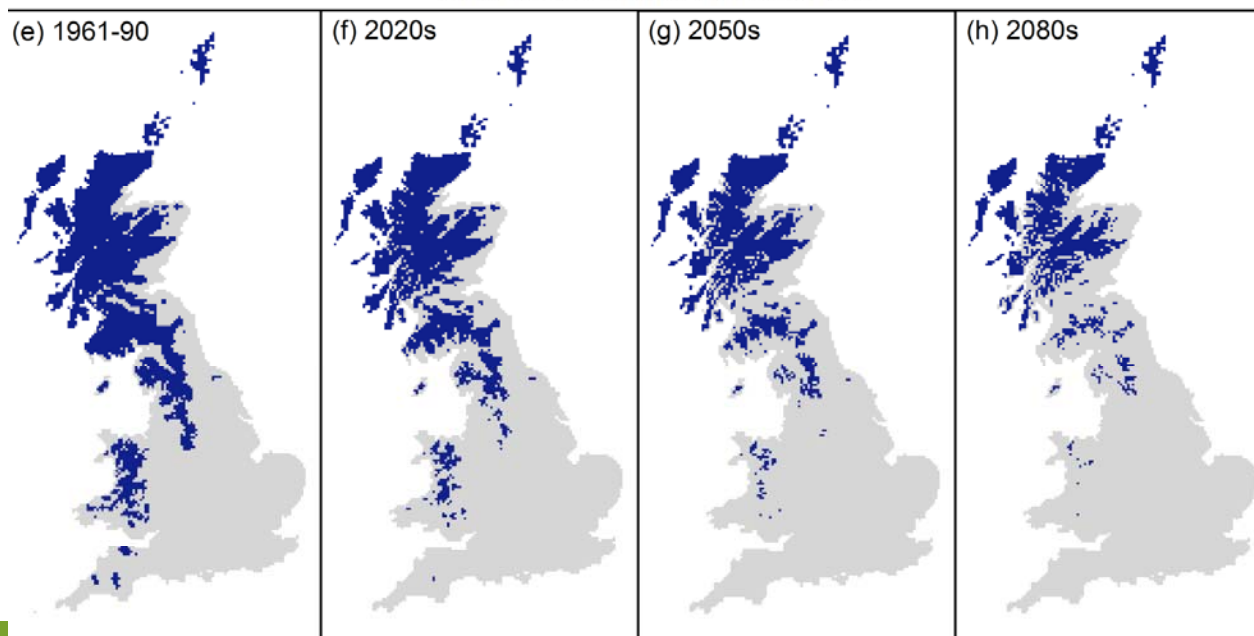


Area covered by the bioclimatic envelope of blanket peatlands predicted by PeatStash using the bioclimatic thresholds associated with the 1961-90 baseline climate for the UKCIP02 high and low emissions scenarios for three time periods: 2020s, 2050s and 2080s.

UKCIP02 High Emissions Scenario



UKCIP02 Low Emissions Scenario



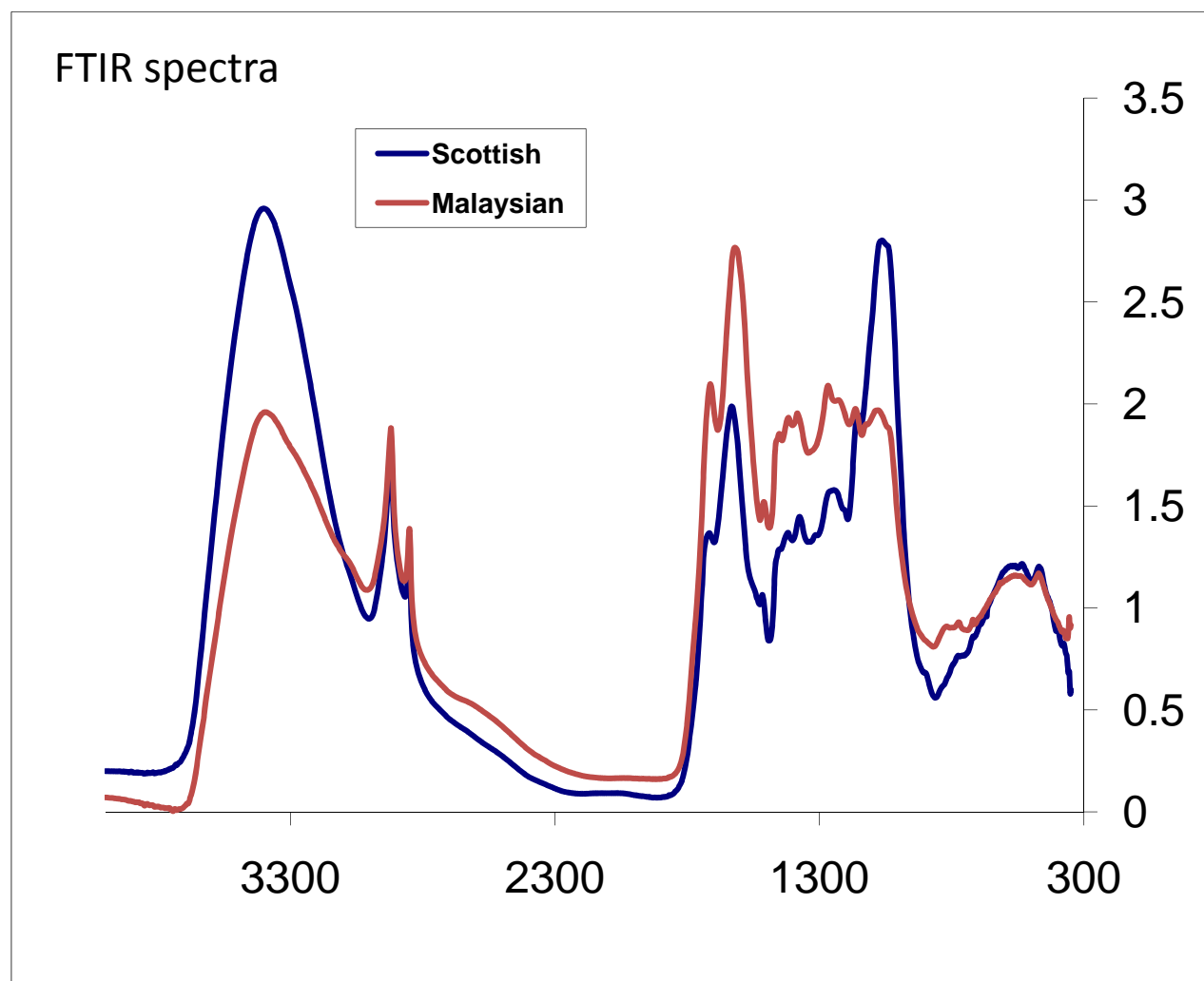
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Gallego-Sala, A.V., Clark, J.M., House, J.I., Orr, H.G., Prentice, I., Smith, P., Farewell, T., Chapman, S.J., 2010. Bioclimatic envelope model of climate change impacts on blanket peatland distribution in Great Britain. Climate Research 45, 151-162.

Northern temperate and tropical peats do differ!



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