Developing carbon metrics for blanket bog – towards a market for carbon storage and sequestration by peatlands

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Aims

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Strategic fit

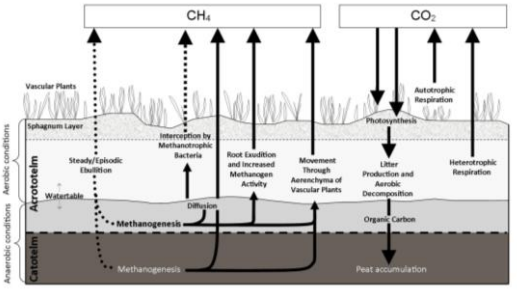
Developing carbon metrics for peatland restoration:

- Encourages reduction of UK carbon emissions from land use
- Helps find new ways to fund ecosystem restoration
- Is designed to be parallel with international schemes (eg Verified Carbon Standard), like Woodland Carbon Code (but ETS is not yet open to GHGs from land-use)… so in the mean time is
- Structured for use with the UK's draft pilot Peatland Carbon Code

Step 1: Development Criteria

- Scientifically credible
- Robust (cope with uncertainties)
- Practical (i.e. can be operated by competent trained individuals)
- Repeatable and suitable for monitoring (clear protocol)
- **Built around an understanding of ecosystem processes**

Carbon Cycling



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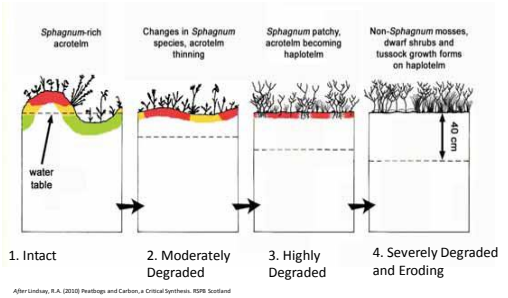
Background to Approach

Environment → Vegetation → Carbon Fluxes

- Develop from continental European approach: MoorFutures (Couwenberg et al. 2011)
- Established relationships between peatland vegetation types and measured GHG fluxes
- Identify Greenhouse gas Emission Site Types (GESTs) and derive standard values for GHG fluxes
- Using these standard values to calculate GHG emission savings for proposed restoration projects
- Existing GESTs do not include blanket bogs, the most common type found in the UK

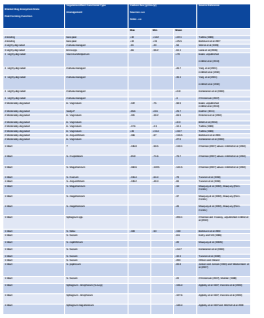
NEED: TO EXTEND GESTs APPROACH TO INCLUDE BLANKET BOGS

Defining Blanket Bog Ecosystem States in relation to peat-forming function



After Lindsay, R.A. (2010) Peatbogs and Carbon, a Critical Synthesis. RSPB Scotland

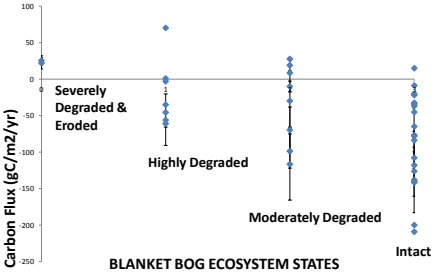
Step 3: Linking Ecosystem States and Carbon Fluxes



- 13 UK data sets from 6 studies
- 9 data sets from 2 studies on the same Irish blanket bog
- 29 data sets from 6 continental studies (Finland, France, Sweden)
- 51 data sets in total.

Ecosystem States & Carbon Fluxes

Linking Ecosystem States and Carbon Fluxes



Ecosystem States & Carbon Fluxes

		Carbon flux (gC/m2/yr)	
Peatland Ecosystem State	**Description**	**Mean**	**Standard Deviation (SD)**
1 Fully functional	Peat-forming *Sphagnum* mosses	**-83.4**	62.7
2 Moderately Degraded	Grasses, sedges & rushes and some Sphagnum mosses	**-33.7**	55.0
3 Highly Degraded	Dwarf shrubs and non Sphagnum bryophytes	**-18.6**	46.0
4 Severely Degraded & Eroded	Bare peat	**+23.8**	2.4

Standard values for blanket bogs

	Plant Functional Types	*Main carbon flux pathways*	*Mean standard GHG flux grams carbon dioxide equivalent ($gCO_2eq/m^2/yr$)*	*Mean standard GHG flux – tonnes carbon dioxide equivalent per hectare per year ($tCo_2eq/ha/yr$)*
BLANKET BOG ECOSYSTEM STATE				
1. INTACT	Peat-forming Sphagnum mosses	Photosynthesis, Oxidation	-305	SINKS 3.0 tonnes
	Non-shunt species	Photosynthesis, Oxidation	-123	SINKS 1.2 tonnes
2. MODERATELY DEGRADED	Shunt species	Photosynthesis, Methane production	-112 *(uncertain)*	SINKS 1.1 tonnes *(uncertain)*
3. HIGHLY DEGRADED	Dwarf shrubs	Photosynthesis, Oxidation	-69	SINKS 0.7 tonnes
4. SEVERELY DEGRADED & ERODED	Bare peat	Oxidation and physical erosion	+3129	EMITS 31.0 tonnes
5. ARTIFICIALLY DRAINED	Presence of artificial drainage channels typically @15-20m apart	Photosynthesis, Oxidation physical erosion	+285	EMITS 2.8 tonnes

These estimates of standard values for greenhouse gas balances are based on a limited number of direct observations, over a limited number of sites, and attempt to describe highly variable processes, so they are a ***first approximation and should not be considered as absolute values***. However, we believe that these estimates are accurate in terms of their relative orders of magnitude.

The metrics

- Derived first approximations for standard values for UK blanket bogs. These metrics can be the basis of a carbon calculator for blanket bog restoration.
- Similar to GEST approach in using vegetation as proxy
- BUT set within ecosystem state & transition framework
- Bare peat appears key to driving emissions from drained and eroding blanket bogs. Orders of magnitude effects

Using these figures

- We used these standard values to estimate the annual greenhouse gas balances associated with blanket bogs in the South Pennines.
- The results show that the **bare peat** surfaces, which occupy less than ten percent of the total peatland area in this region, are **emitting** as much carbon as the other ninety percent of the vegetated peatland area is capturing and storing.

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Block grips...

... or reduce grazing

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Challenges:

- Work in progress
- Values based on very few direct emissions measurements with considerable uncertainties
- Need more data on magnitude of fluxes through all pathways especially POC and DOC
- Assumption of reversibility of ecosystem transitions
- Need standardised field protocols for operation

Conclusions...

Can we use proxies and develop evidence based carbon metrics that would underpin a voluntary code for peatlands?

- **YES**, it is possible to use proxies, and to develop evidence-based metrics, and we have produced a first approximation.
- We summarised the data required, and designed the approach so that it is standardised and is transferable to other sites.
- Our approach, because it focuses on vegetation and ecosystem functionality, can be used to quantify changes in service provision from specific interventions.

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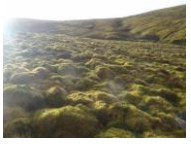
Thank You



Peat condition & climate

Peatland condition	Type of ecosystem service	Quality of ecosystem service	Flow of ecosystem service	Effect on climate
Healthy peatland	Carbon sequestration and storage	Very good	Improving	Beneficial
Grazed peatland	Carbon storage	Adequate	Steady or deteriorating	Variable
Burnt peatland	Carbon storage	Adequate	Steady or deteriorating	Variable
Degraded peatland	Carbon storage	Poor	Deteriorating	Damaging
Eroding peatland	Carbon storage	Very poor	Deteriorating	Damaging

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