UK Centre for Ecology & Hydrology

Flux observations in the net zero world

- Flux tower network
- Peatlands
- Agriculture
- Bioenergy
- GGR

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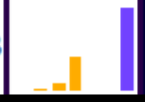
6th Carbon budget: 'balanced pathway'

Table 2
Key metrics for actions in the Balanced Pathway to meet the Sixth Carbon Budget

		2019	2025	2030	2035	2050	Trend
UK greenhouse gas emissions	UK greenhouse gas emissions ($MtCO_2e$)	522	445	316	191	0	
	UK greenhouse gas emissions per person (tCO_2e/capita)	7.8	6.5	4.5	2.7	0	

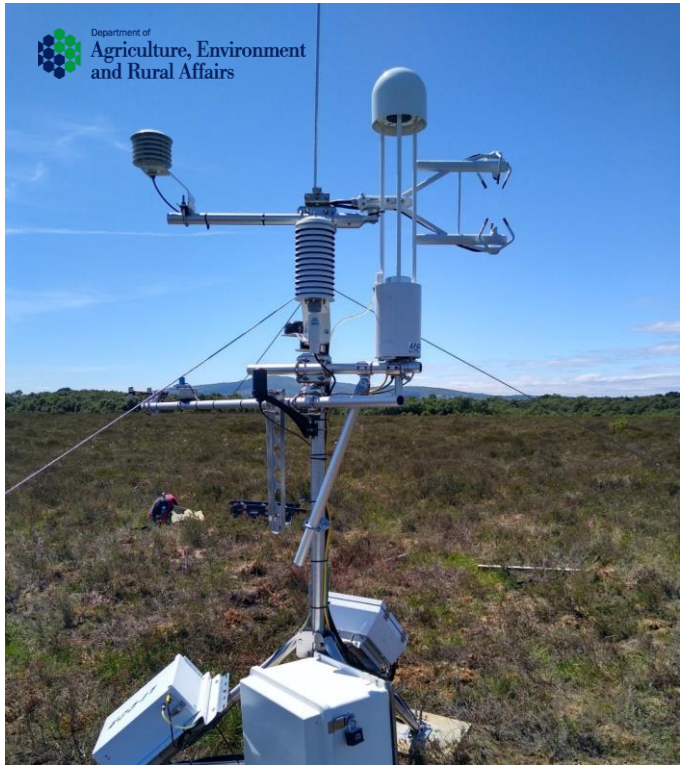
...

Land	UK woodland area	13%	14%	14%	15%	18%	
	Energy crops (kha)	10	23	115	266	720	
	Peat area restored	25%	36%	47%	58%	79%	
	Land-based carbon sinks ($MtCO_2$)	18	18	20	23	39	
Removals	Greenhouse gas removals ($MtCO_2$)	0	<1	5	23	58	

Flux observations in the net zero world

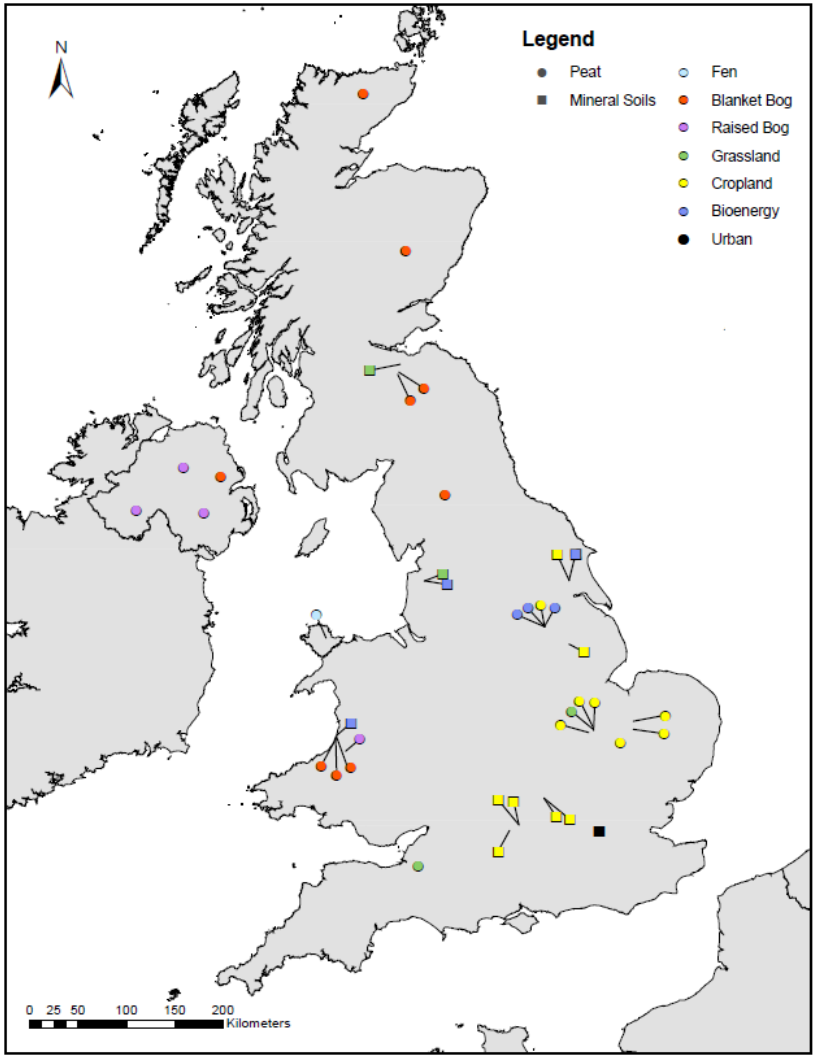
- What is the greenhouse gas balance of the land surface, how is it changing, what are the drivers of change?
- Can land be managed for decreased GHG emission and/or increased C storage?
- At what co-benefit and/or trade-off?
- How resilient are terrestrial C stocks to environmental change?
- Measurable, reportable, verifiable (e.g. for ELMS payments…)

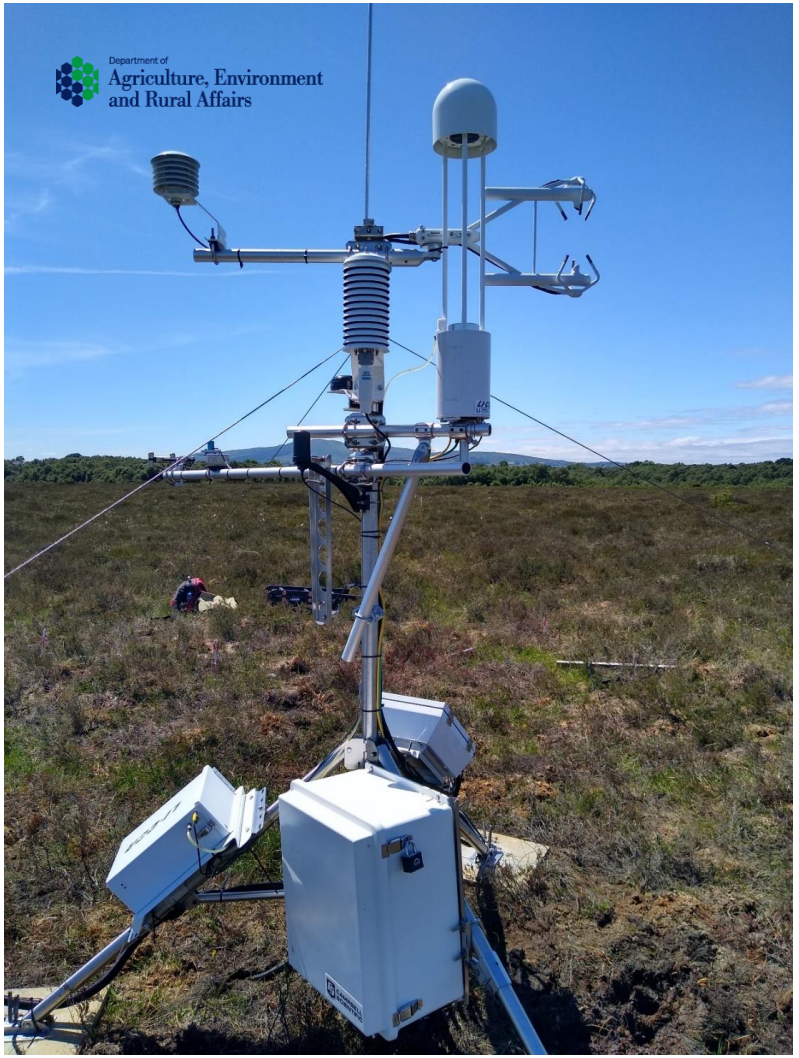
Eddy covariance 101



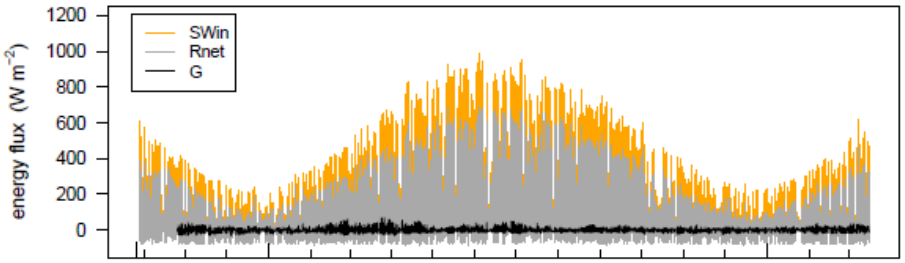
- Turbulent transport of mass & energy between land and atmosphere
- High frequency (30 min) observations of ecosystem processes
- Direct & continuous measurements at intermediate space scale (10s-100s m^2)
- Underpins land C and GHG emissions accounting, water budgeting

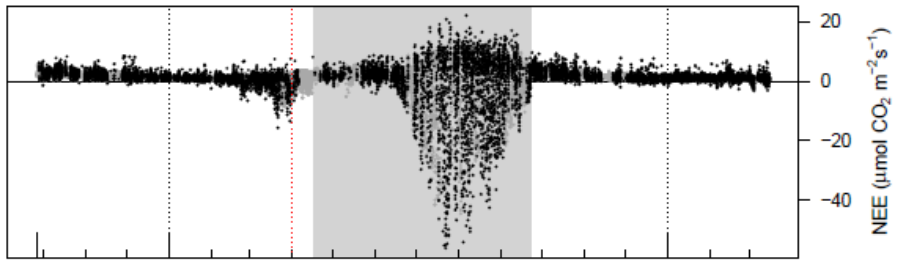
National flux tower network (March 2022)

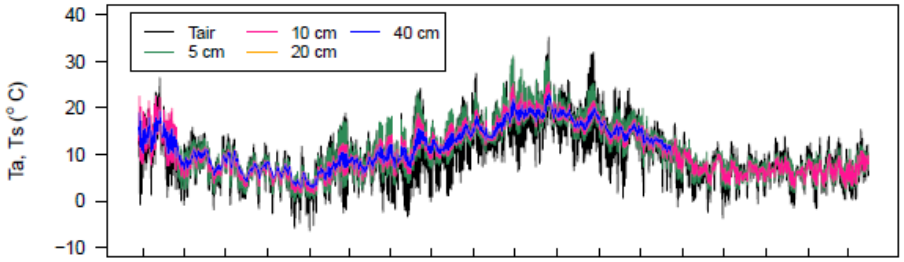


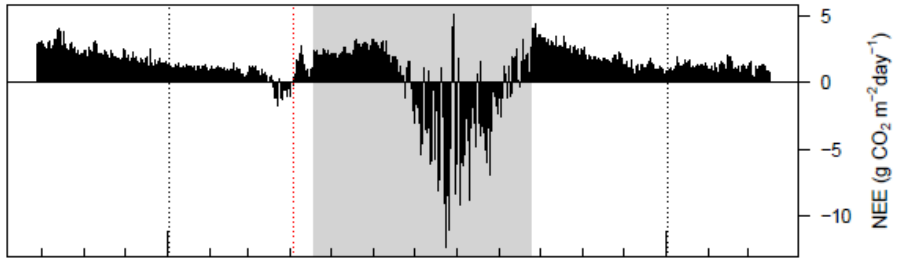


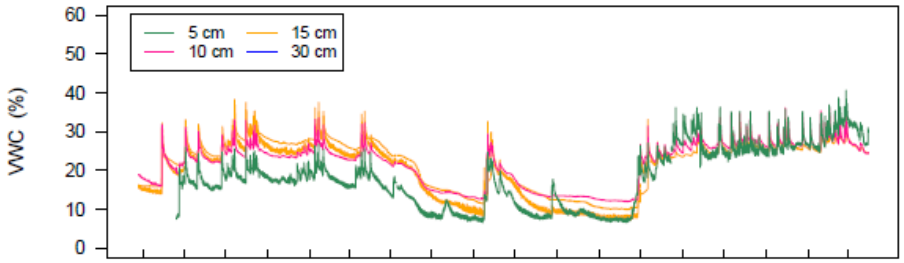
Cambridgeshire Fens, Biogas maize

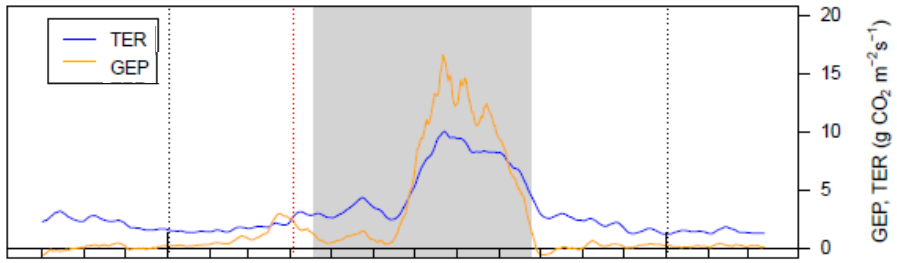


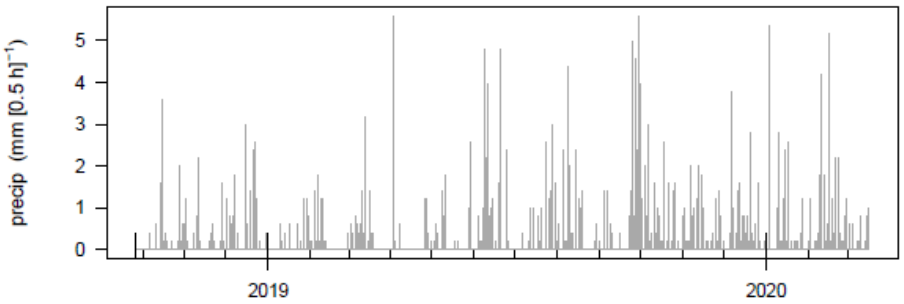


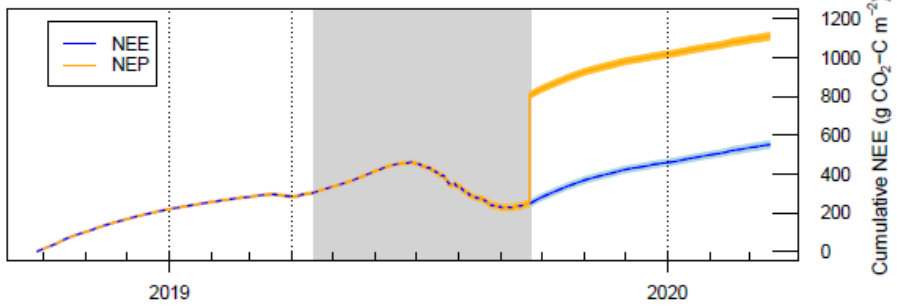












UK peatland flux synthesis

Article

Overriding water table control on managed peatland greenhouse gas emissions

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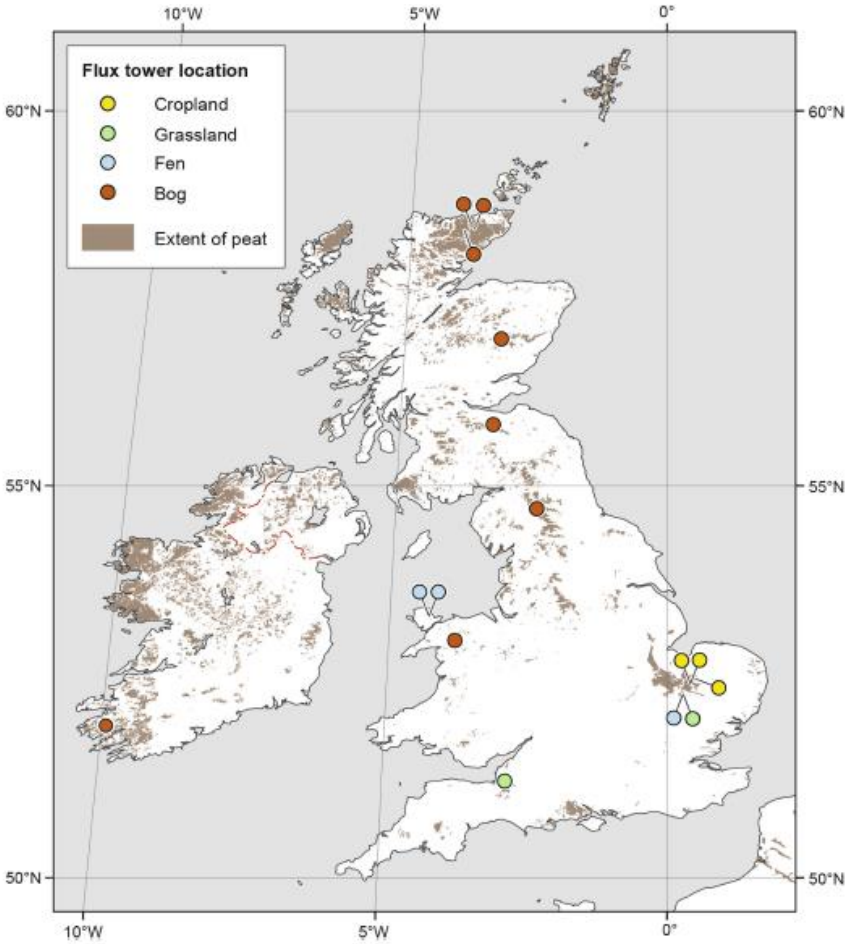
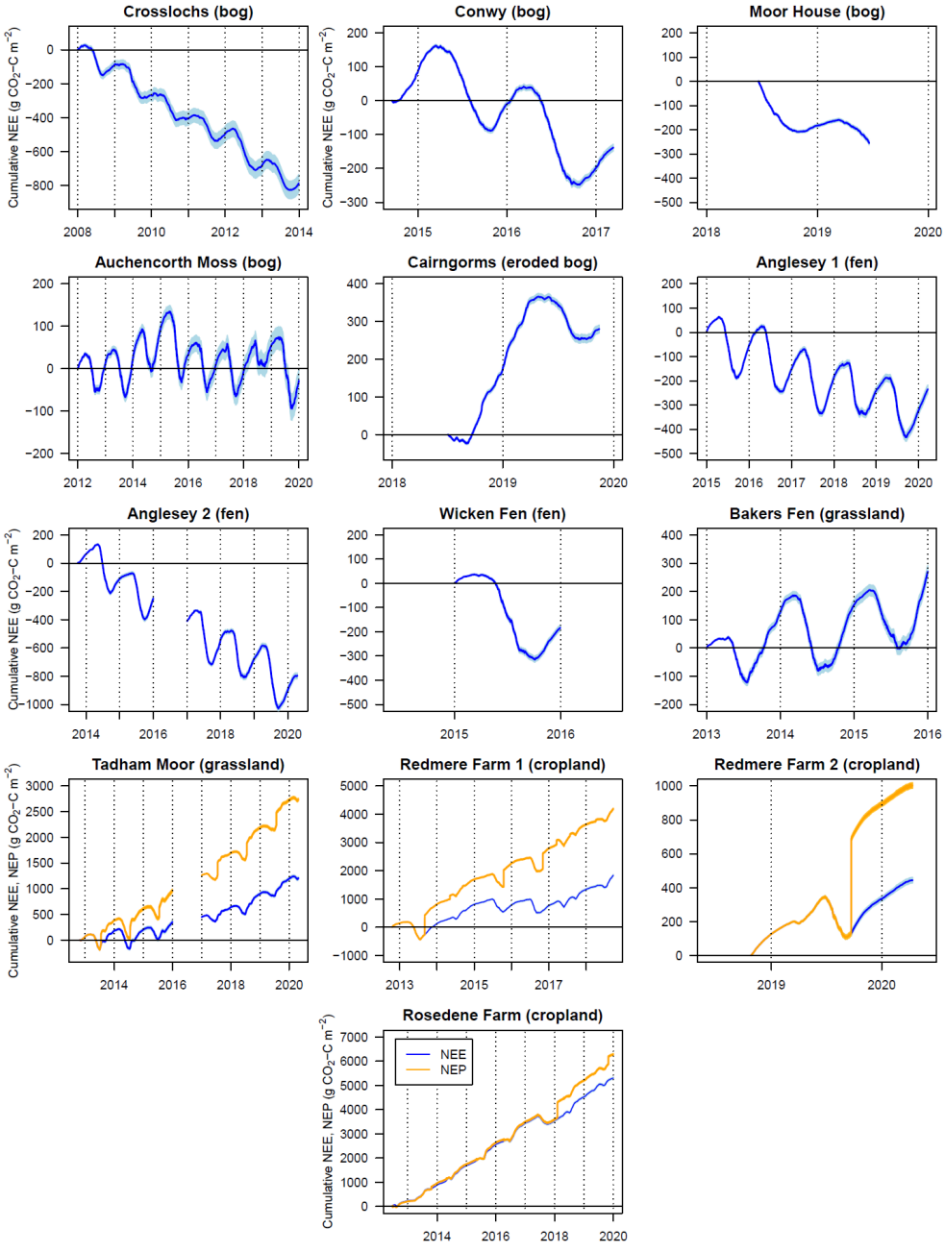
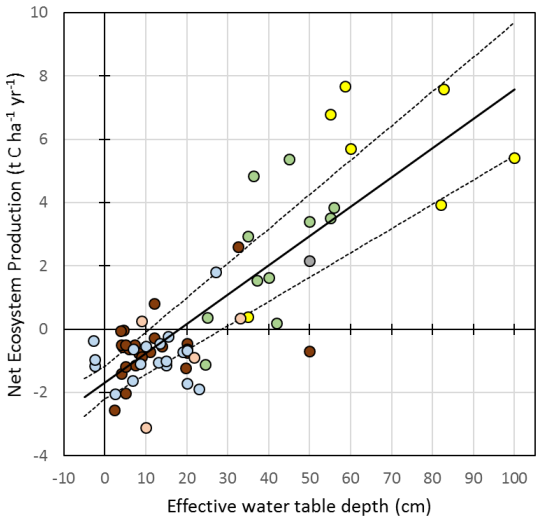


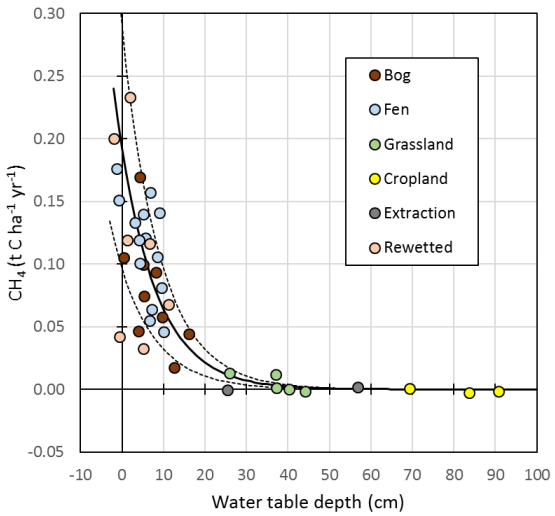


Global peatland flux synthesis

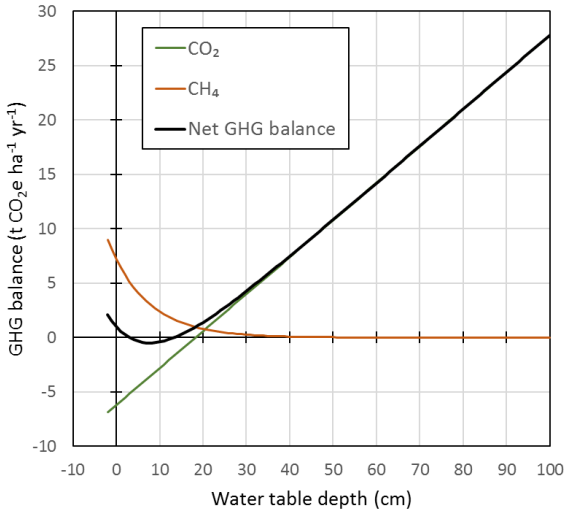
CO_2 vs water table



CH_4 vs water table



GHG balance vs water table



- Global agricultural peat emission **0.79** Gt CO_2e yr^{-1} (**1.6%** of global GHG emissions)
- Full restoration would reduce emissions to **zero ±0.15** Gt CO_2e yr^{-1}
- Halving mean drainage depth would reduce emissions to **0.28** Gt CO_2e yr^{-1}
- **<u>Reduced drainage intensity could reduce global GHG emissions by 1%</u>**
- Not necessarily incompatible with continued agricultural production – but the practicalities (e.g. water management, crop selection) remain challenging

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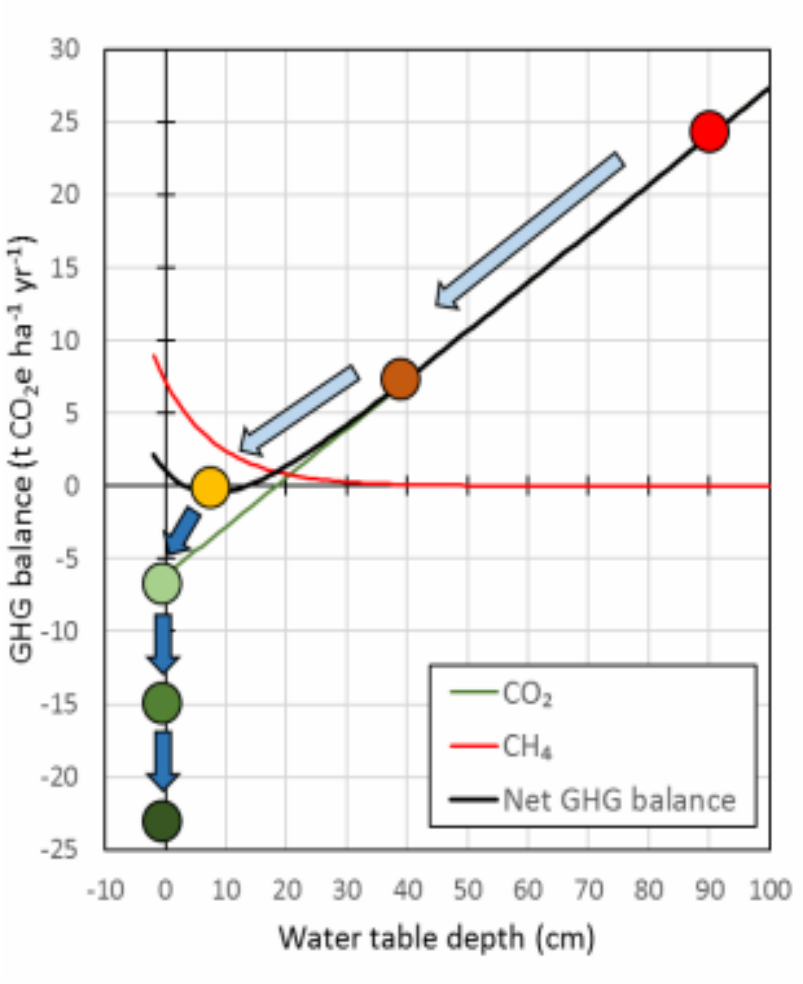
Evans *et al.* (2021), *Nature* ***593****, pages 548–552*

Avoided emissions to GHG removal?



Current emissions from cultivated peatlands

Limit of agricultural mitigation

Limit of restoration mitigation

Avoided emissions

Restoration + CH_4 suppression

+

Maximised productivity

+

Minimised decomposition

GHG removal

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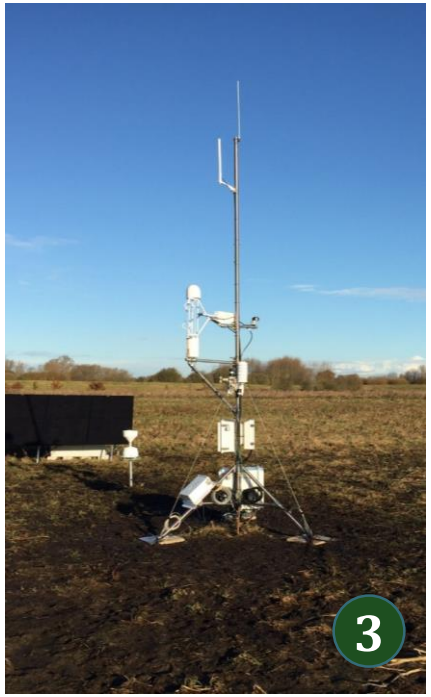

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University of East London

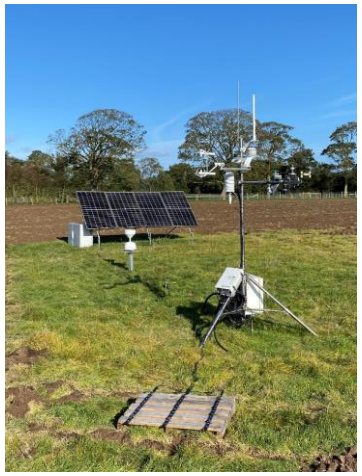
PERENNIAL BIOMASS CROPS
PBC4GGR
GREENHOUSE GAS REMOVAL

- Biomass with carbon capture & storage (BECCS)
- Field trials, flux towers, modelling…
- Website: https://pbc4ggr.org.uk/

PERENNIAL BIOMASS CROPS

PBC4GGR

GREENHOUSE GAS REMOVAL



Summary

- Greenhouse gas flux measurements and expanding network of monitoring sites
- Examples from past and current work on agriculture, bioenergy and peatlands (not mutually exclusive!)
- Future focus on land-based greenhouse gas removal (GGR) on peat and mineral soil
- Agro-forestry, regenerative agriculture, solar farms...

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