

Heather Management

A contentious issue

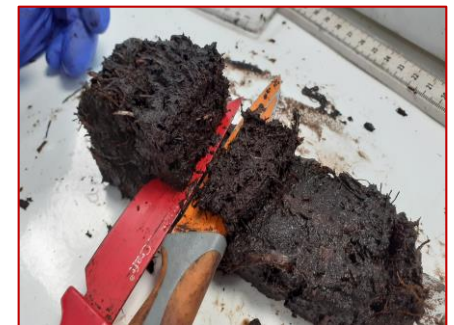


Shining a light on prescribed fire: claims versus evidence

Considering habitat, peat cores, experiments, scale, knowledge gaps and wildfire



Dr. Andreas Heinemeyer
University of York (SEI)



A few years ago - working together towards an outcomes approach!



The Moorland Association logo (a purple bird) and the Natural England logo (a green square with the text 'NATURAL ENGLAND') are at the top. The main text reads: **Blanket Bog Restoration – shared challenge; shared outcomes.** Below this, it lists **Mark Owen - Natural England** and **Amanda Anderson – Moorland Association**. At the bottom left, the website www.gov.uk/natural-england is provided.



Clearly the right direction!

So, what went wrong ?

Was it **science**?

Was it **evidence**?

→ What do leading scientists actually say?

Produced by Uplands Management Group for DEFRA's Upland Stakeholder Forum. Enormous thanks to Moors for the Future for staff and print resources



Three covers of the 'BLANKET BOG LAND MANAGEMENT GUIDANCE' are shown side-by-side. The first cover is brown and titled 'Frequently asked questions'. The second cover is purple and titled 'Decision making toolkit'. The third cover is grey and titled 'Outcomes and improvements'. Each cover features a photograph of blanket bog at the bottom.

EVIDENCE on Burning

Davies et al. (2016):

*“In the **absence of sound evidence & consensus**, it is vital that managers and scientists adopt an **‘adaptive approach’** and keep an open mind until the evidence is settled”*



Harper et al. (2018):

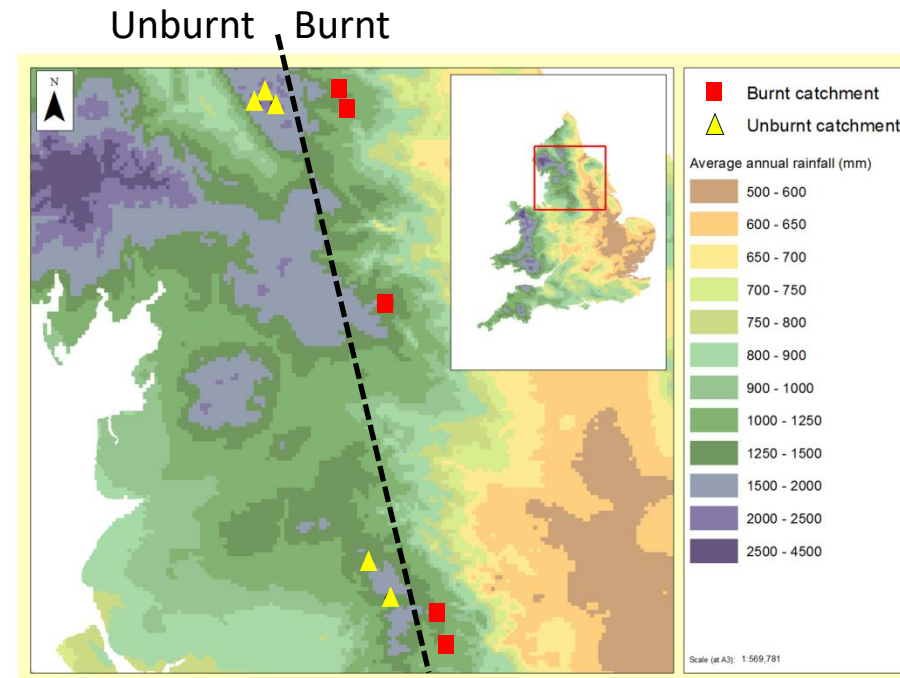
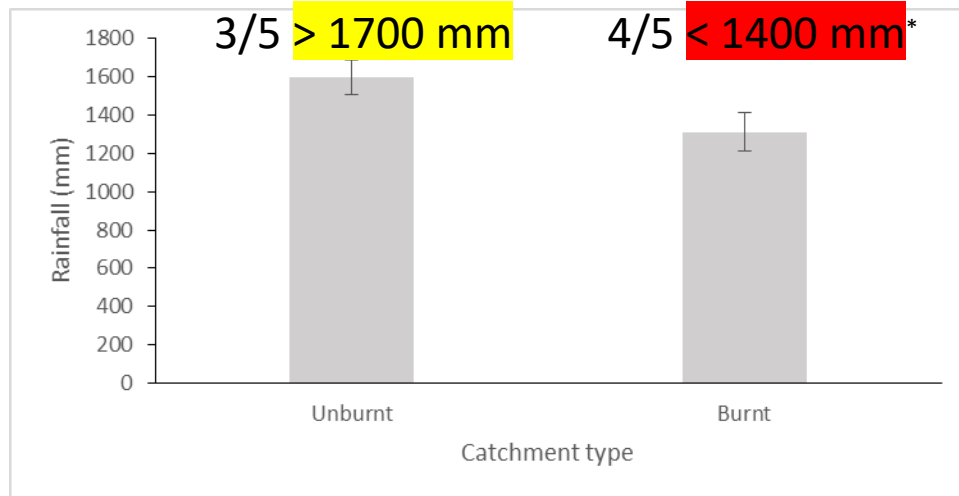
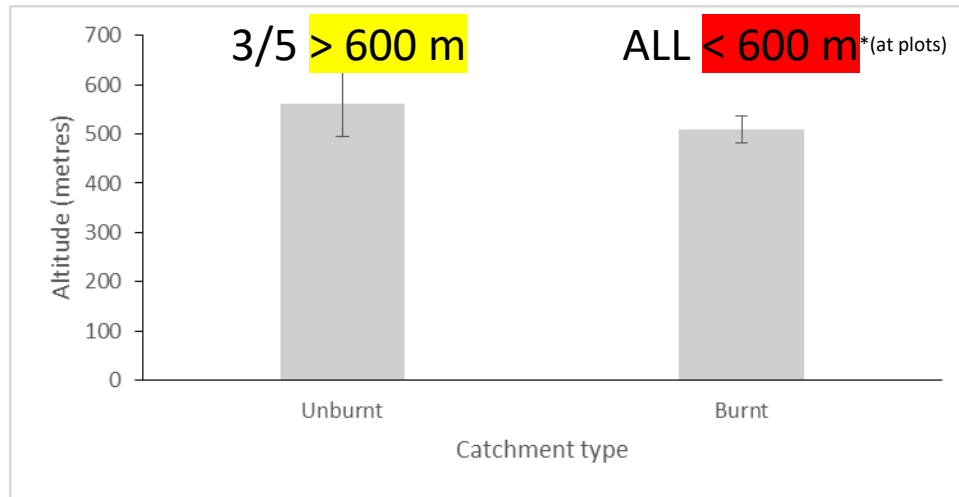
*“Prescribed burning, under a changing climate, could either be a **useful tool** or a **highly damaging process** without sufficient research; **wildfires** could become a **major risk**”*



- There is no **consensus** about controlled burning being ‘damaging’ (evidence is conflicting)
- Impacts of **burning** depend on site condition and negative impacts mostly short-lived
- Many studies show several benefits on **ecological functions** (carbon, water, diversity)
- Comparisons lack spatial and temporal **scale** considerations (> m² plot; > 3 years)
- Need for long-term (management cycle!) Before-After Control-Intervention (**BACI**)

Study design: EMBER (NERC)

‘Space for time’ study: assumes **all is the same at all sites** (10) apart from management, **but is it?**



And: (1) difference in vegetation type (NVC)
(2) unburnt 33% larger catchments

→ SITE (e.g., rainfall) should be considered in statistics but was excluded or cannot be included

CLAIMS

POSITION STATEMENT: Burning and peatlands



The IUCN UK Peatland Programme (IUCN UK PP) is a partnership of environmental NGOs, statutory agencies, land managing bodies' and scientists collectively working for the conservation and restoration of peatlands. Our work brings together strong science, sound policy and effective practice by creating a platform for information exchange and providing briefings.

Response:

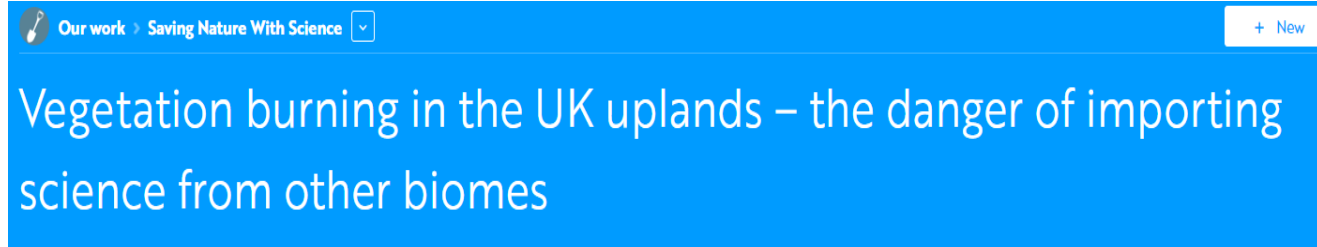
Ashby & Heinemeyer
(2021)

Carbon Storage and Sequestration by Habitat 2021 (NERR094)



This record was published by Natural England on 20 April 2021.

Heinemeyer & Ashby
(2023)



Twitter ...

Peat formation:



Peatland Programme

Position statement: Burning & Peatlands v.4

*“dominance of **non-peat-forming** vegetation such as common **heather**”*

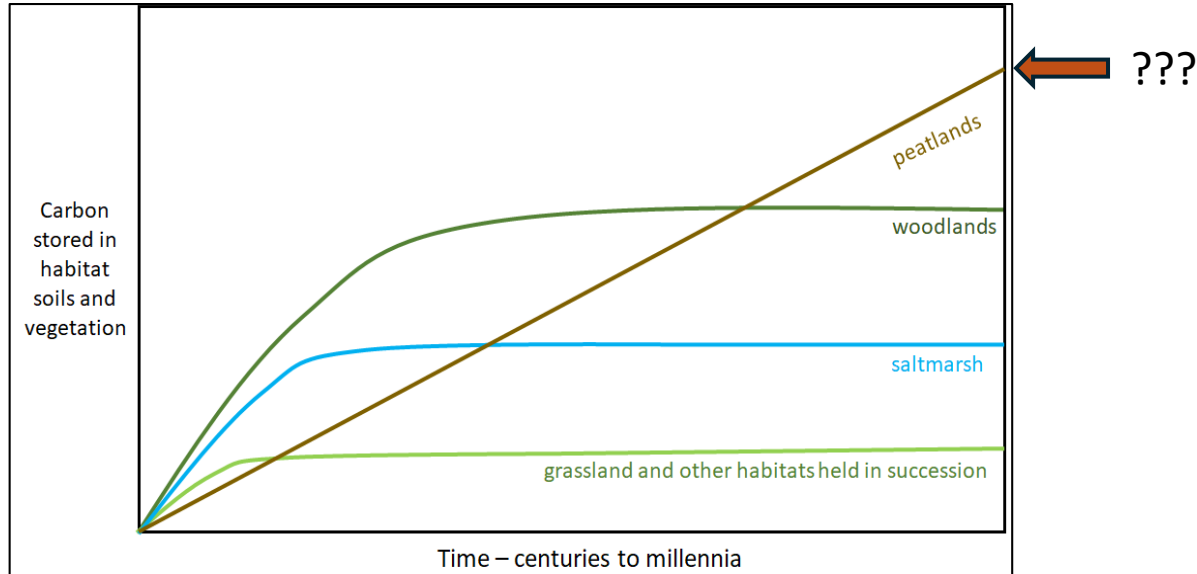
Briefing Note N° 2

*“**heather** stems and roots can sometimes **make significant contributions to the peat**”*

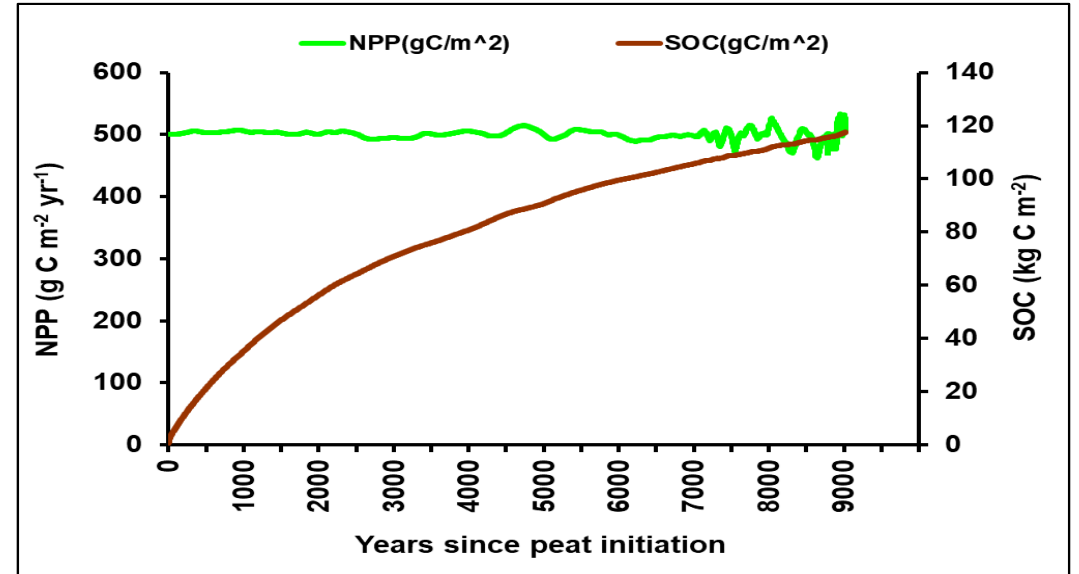
- The concept of '**peat-forming**' species is ill-defined (any vegetation can form peat!)
- The main factor is **site conditions** (water table, pH, topography!) not vegetation
- **Sphagnum** moss can enhance peat-formation (if conditions are limiting otherwise!)
- **Heather & sedges** are listed as key peat-forming species (by the JNCC and the IUCN!)

Peatlands as climate 'heroes' or 'saviours':

Gregg et al. (2021) [Natural England; NERR094]



Heinemeyer et al. (2010) [modelled data]



- Carbon gains are **limited** (asymptotic decline due to mass balance of C in vs C out!)
- **Old peatlands** have a very small overall impact on the climate (slow carbon gains!)
- **Young peatlands** can have a considerable climate benefit (big carbon gains!)
- Main carbon benefit in the UK is from **avoided emissions** (stopping erosion & drainage!)

Burning causes huge carbon & GHG emissions:

RSPB tweet:



Ref 36 Worrall F (2010). Assessment of GHG Fluxes from Upland Peat Soils. Pers. Comm. Draft report for Defra.

Unvalidated model (and no charcoal)
Worrall et al.: **no generalisation!**



Vanessa Amaral-Rogers (RSPB)

18 Jan 2022



“Despite these protections, our peatlands are a net source of emissions with **74% of emissions from blanket bog attributed to burning.**”



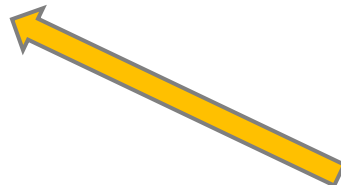
Citing: England's peatlands: carbon storage and GHGs (NE257)



Table 4: Emissions factors used by Natural England to estimate greenhouse gas flux from England's peatlands under a range of managements. Units are tonnes CO₂-e ha⁻¹ yr⁻¹. No factors were available for peatlands supporting woodland, scrub, semi-natural vegetation, purple moor-grass or with old peat cuttings.

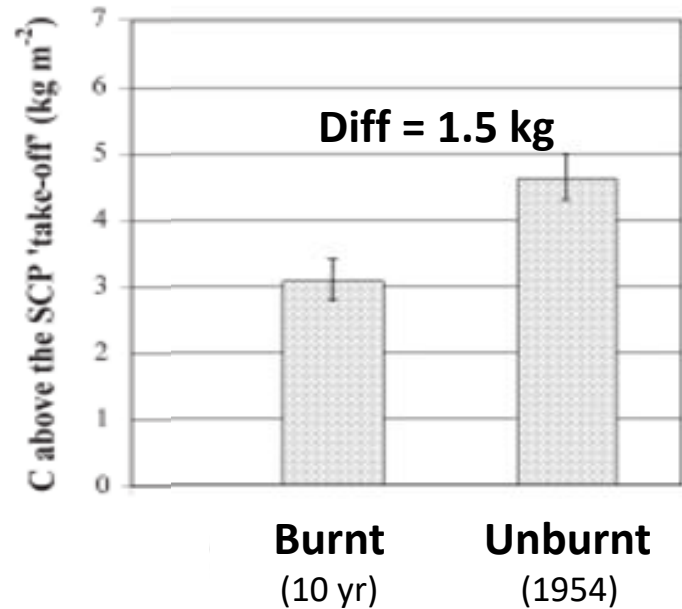
	Blanket Bog/ Raised Bog	Fen Peatlands (deep)	Fen Peatlands (wasted)	Shallow Peaty Soils
Cultivated & temporary grass	22.42c	26.17e	4.85g	18.32a
Improved grassland	8.68d	20.58f		0.92a
Extracted	4.87a	1.57a		
Rotationally burnt	2.56b			

b Based on simplified version of Durham Carbon Model (Worrall, 2010) ³⁶

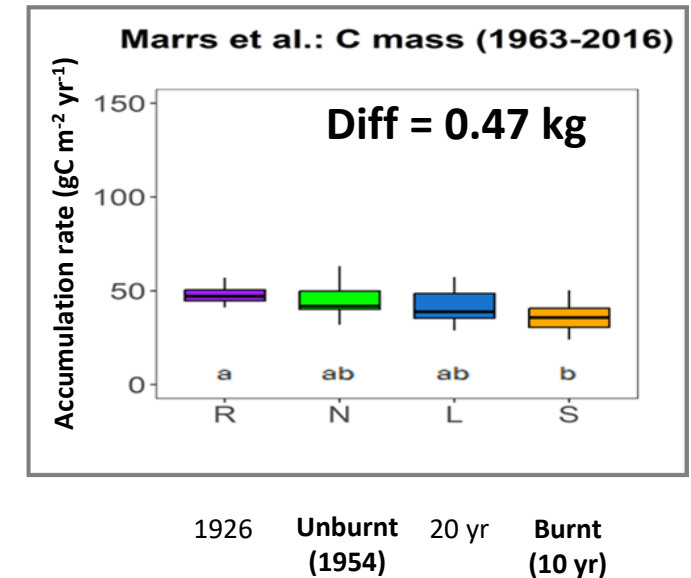


Peat Carbon: Moor House (Hard Hill)

Garnett et al. (2000); (age/depth ?)



Marrs et al. (2019); (%C_{org} ?)

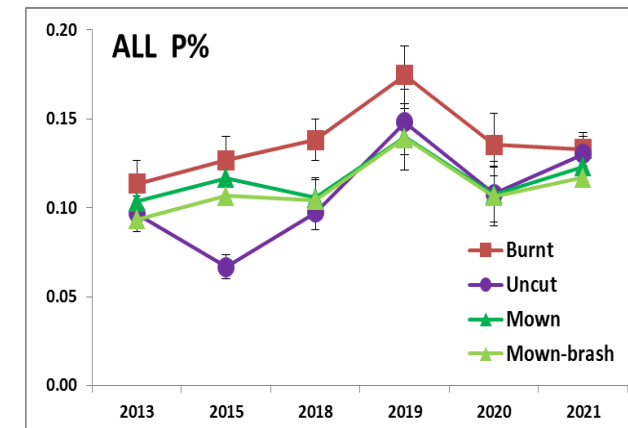
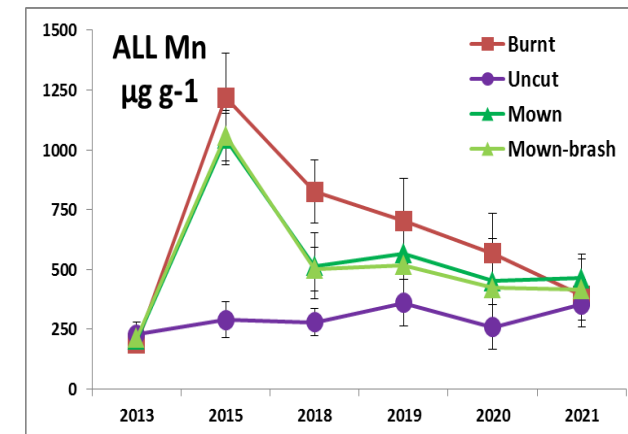
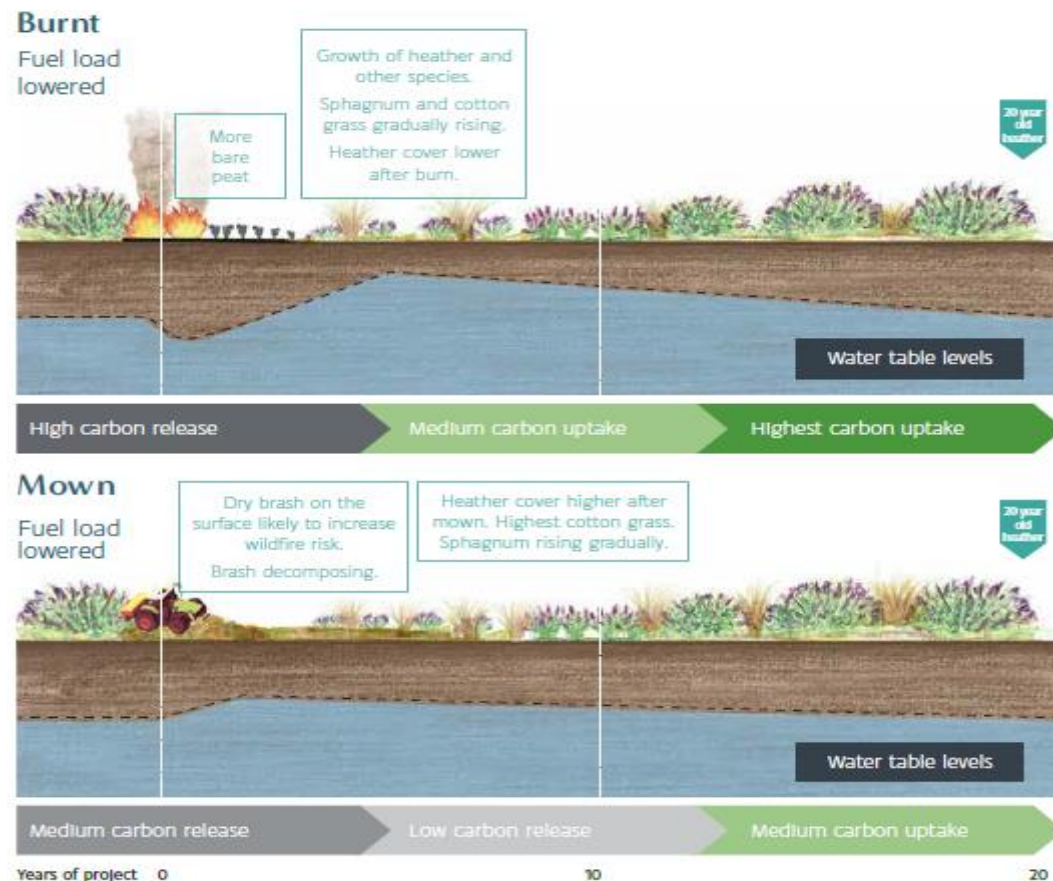


Moor House (Hard Hill) experiment offers a robust assessment of burn impacts:

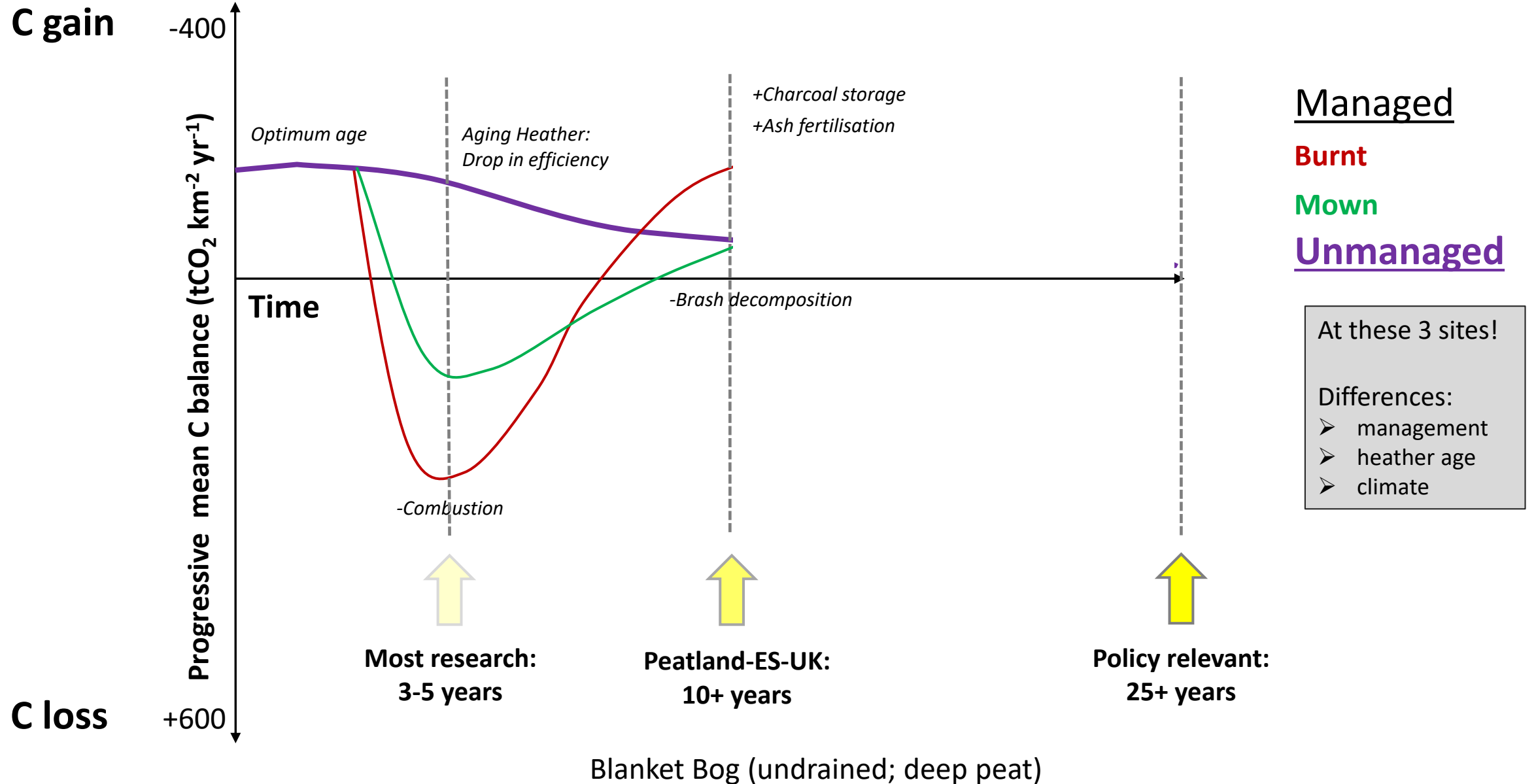
- 1st assessment (Garnett et al.) suffers from questionable **age-depth** method.
- 2nd assessment (Marrs et al.) lacks detailed and direct measurements of **carbon content**.
- 3rd assessment (Heinemeyer et al.) addresses all these issues. No difference (**charcoal effect**)!

Heather management: Peatland-ES-UK (Defra et al.)

- Far less is known about impacts from **cutting vs. burning** (reviews and studies)
- Burning & cutting result in **C losses** (short-term combustion vs. long-term decomposition)
- Cutting results in short-term **wetness** gain but loss of **micro-topography** (surface)
- Management enhances **C uptake** mostly for burning (nutrients/ash)



Carbon balance: Peatland-ES-UK (Defra et al.)

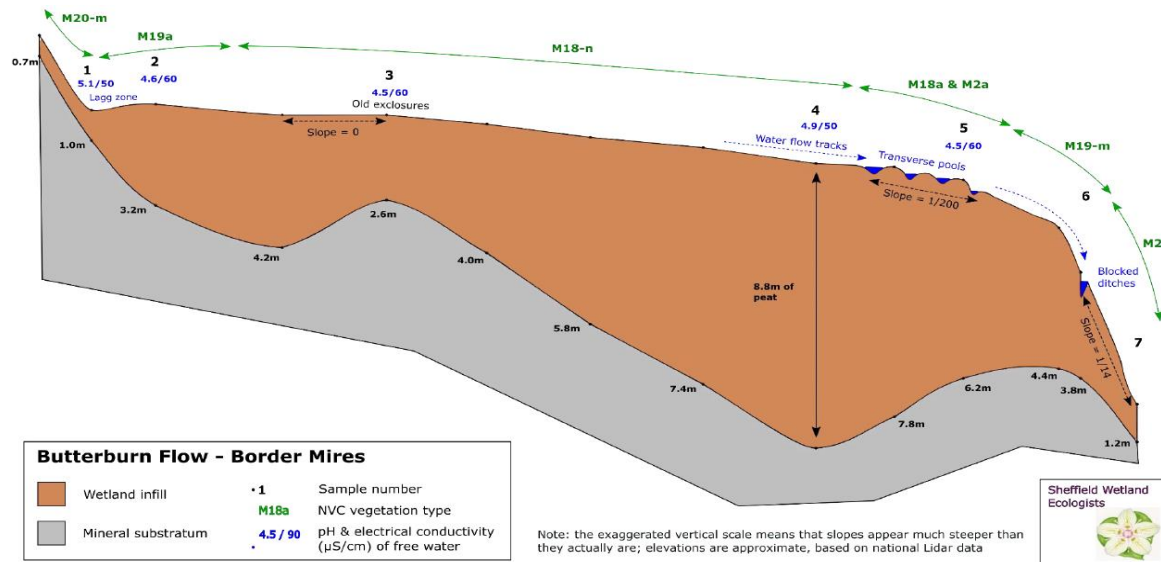


Habitat status:

Ecohydrology:

→ much of 'Border Mires' & 'Flow Country' *topogenous* bog NOT typical (hill) blanket bog !

Wheeler et al. (2023)/ Eades et al. (2021)



Glatzel et al. (2023)

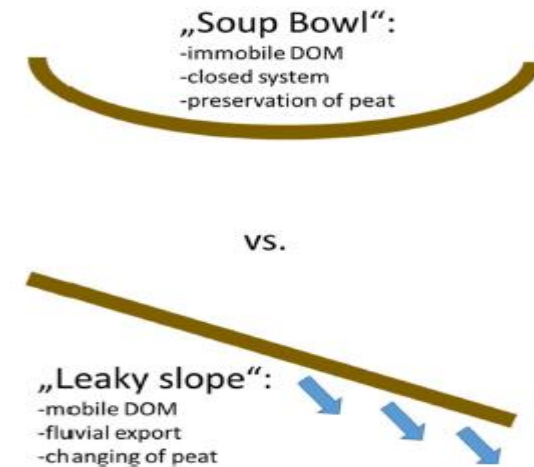


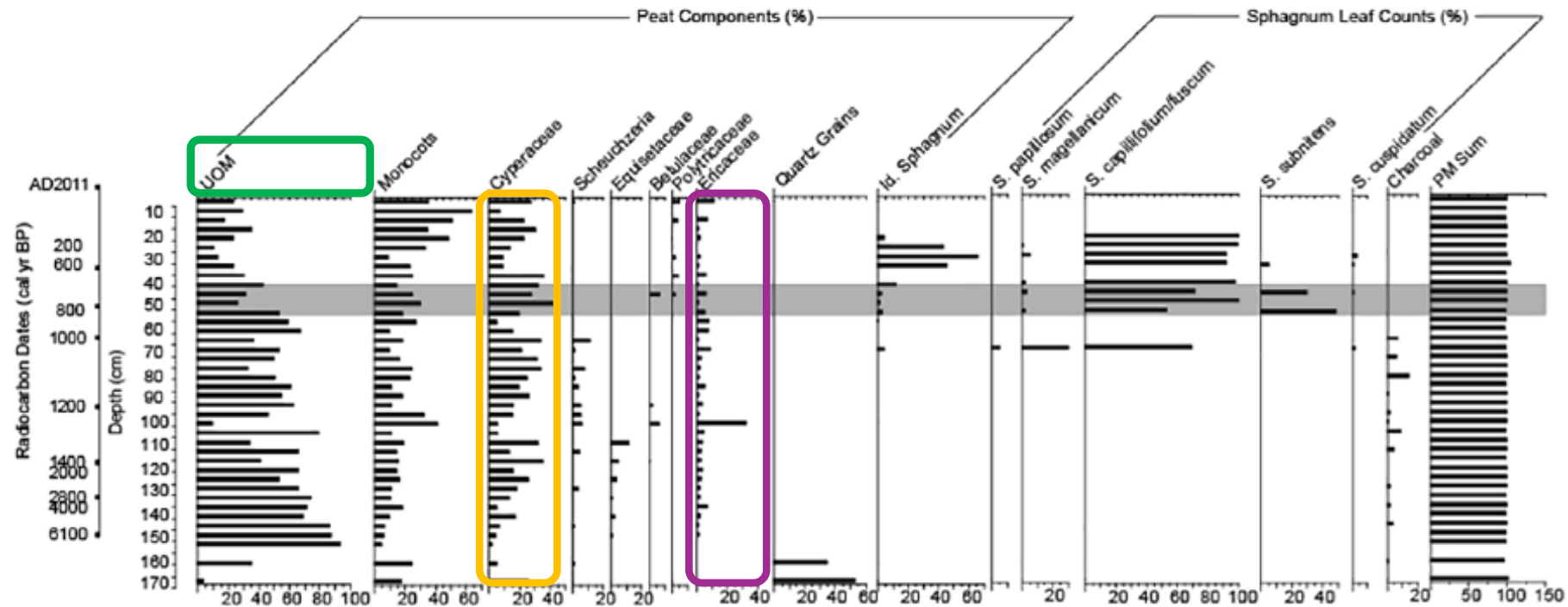
Fig. 6 Visualisation of the "acidic soup bowl" and the "leaky slope" situation at the continental raised bog and the Atlantic blanket bog

- Categories of 'intact' vs 'degraded' or 'modified' are **ill-defined** (functions & thresholds)
- Current status often lacks **historic context** (pollution, management, events)
- Assumed causes of degradation often **confounded** with other factors (mainly drainage)
- Not as 'good' as 'intact' site often due to **ecohydrology** (climate/bedrock/topography)

Natural vegetation:

- **Trees** were never a substantial part of blanket bogs (peat core evidence)
- High **heather cover** is often natural even on wet peat (climax vegetation)
- Evidenced in **peat cores** over thousands of years (often cycles of dominance)

MDM [Webb et al. (2022)]



Rewetting protects:

Soup Bowl vs Leaky Slope:

Glatzel et al. (2023)

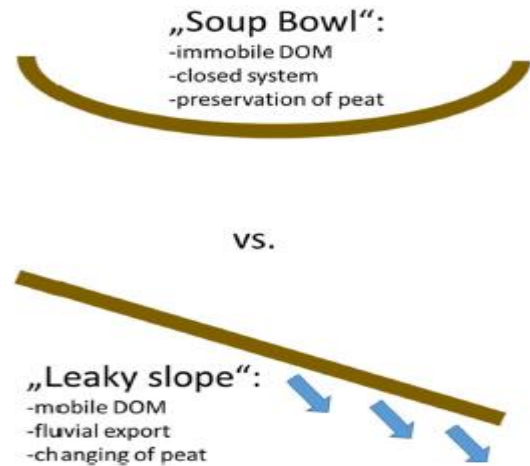


Fig. 6 Visualisation of the “acidic soup bowl” and the “leaky slope” situation at the continental raised bog and the Atlantic blanket bog

Site specific context: **misconception of rewetting**

(not all peatlands can be as wet as parts of Border Mires/Flow Country)

Many blanket bogs: **limited or no rewetting potential**

(often no drains, climatic & topographic limitations)

Heather biomass: **grows very well on wet sites**

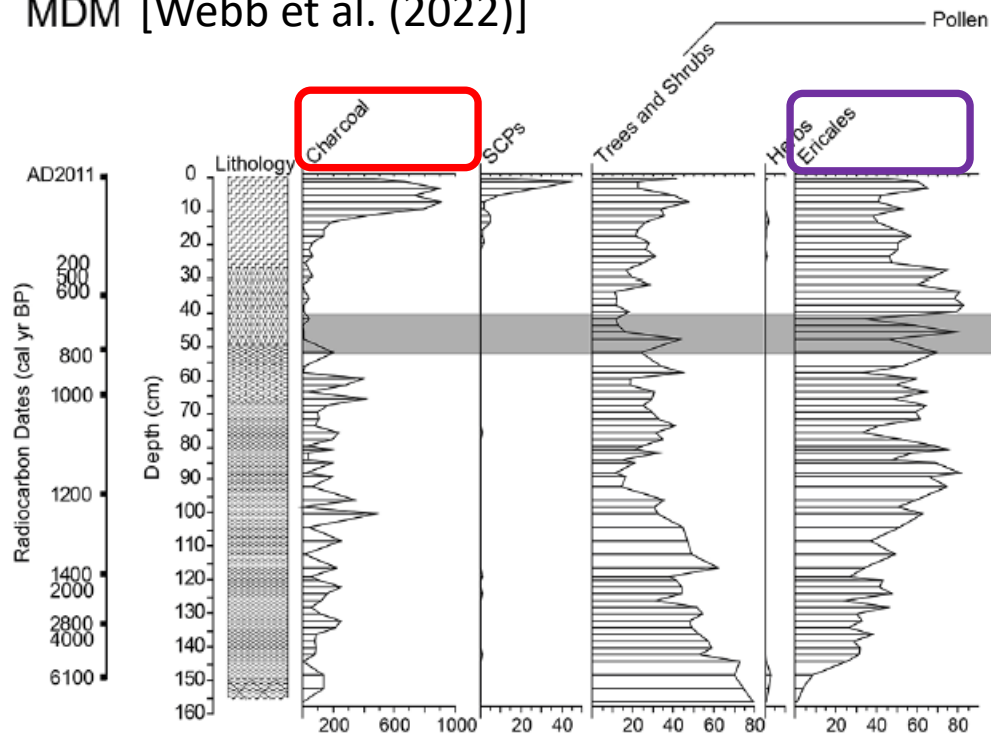
(no evidence of a generic reduction after ‘rewetting’)

- No evidence for a **generic** protection against wildfire (rewetting limitations)
- Even wet bogs can **periodically dry out** during drought (seasonal)
- Shrub **biomass** and fuel loads could increase (limited water stress)

Fire frequency:

- **Fire** is not an issue of “*if but when*” (ignition, fuel load, weather conditions)
- Even **wet peatlands** can burn (and smouldering fire can dry out peat)
- Peat cores clearly show frequent **historic fires** over thousands of years (charcoal layers)

MDM [Webb et al. (2022)]



Peak District

Howden Moor (National Trust)



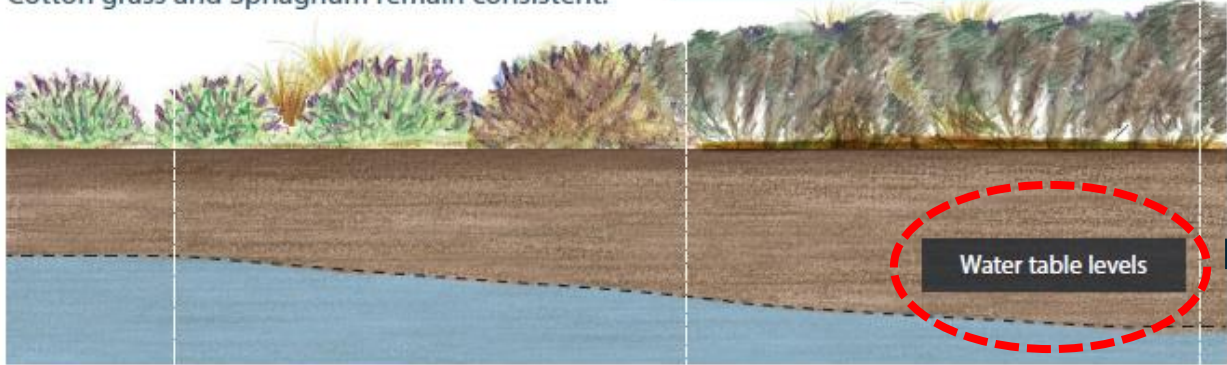
No heather management: Peatland-ES-UK

Unmanaged

Highest heather cover throughout.
Cotton grass and Sphagnum remain consistent.

Old, woody Heather
Biodiversity dropping
Wildfire risk high

45 year old heather



High carbon uptake

Medium carbon uptake

Low carbon uptake

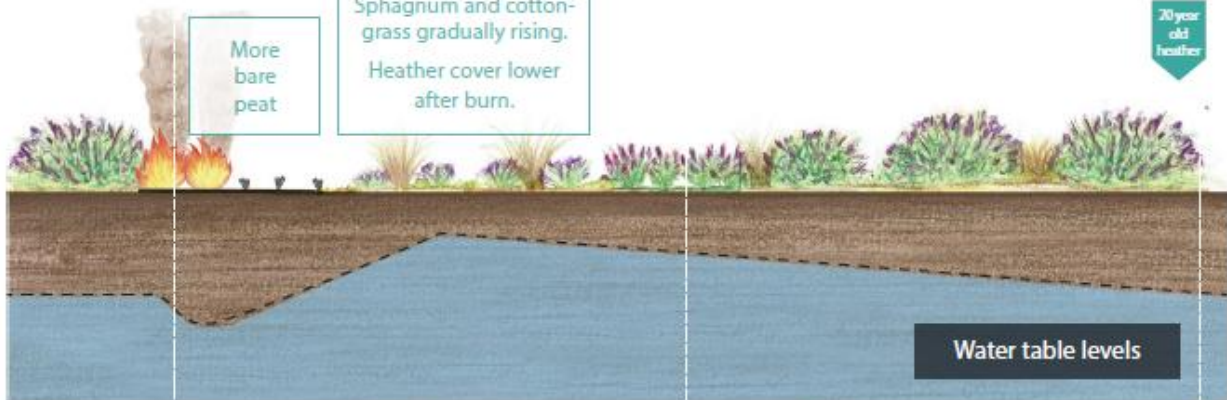
Burnt

Fuel load lowered

Growth of Heather and other species.
Sphagnum and cotton-grass gradually rising.
Heather cover lower after burn.

More bare peat

20 year old heather



High carbon release

Medium carbon uptake

Highest carbon uptake

> Transpiration =

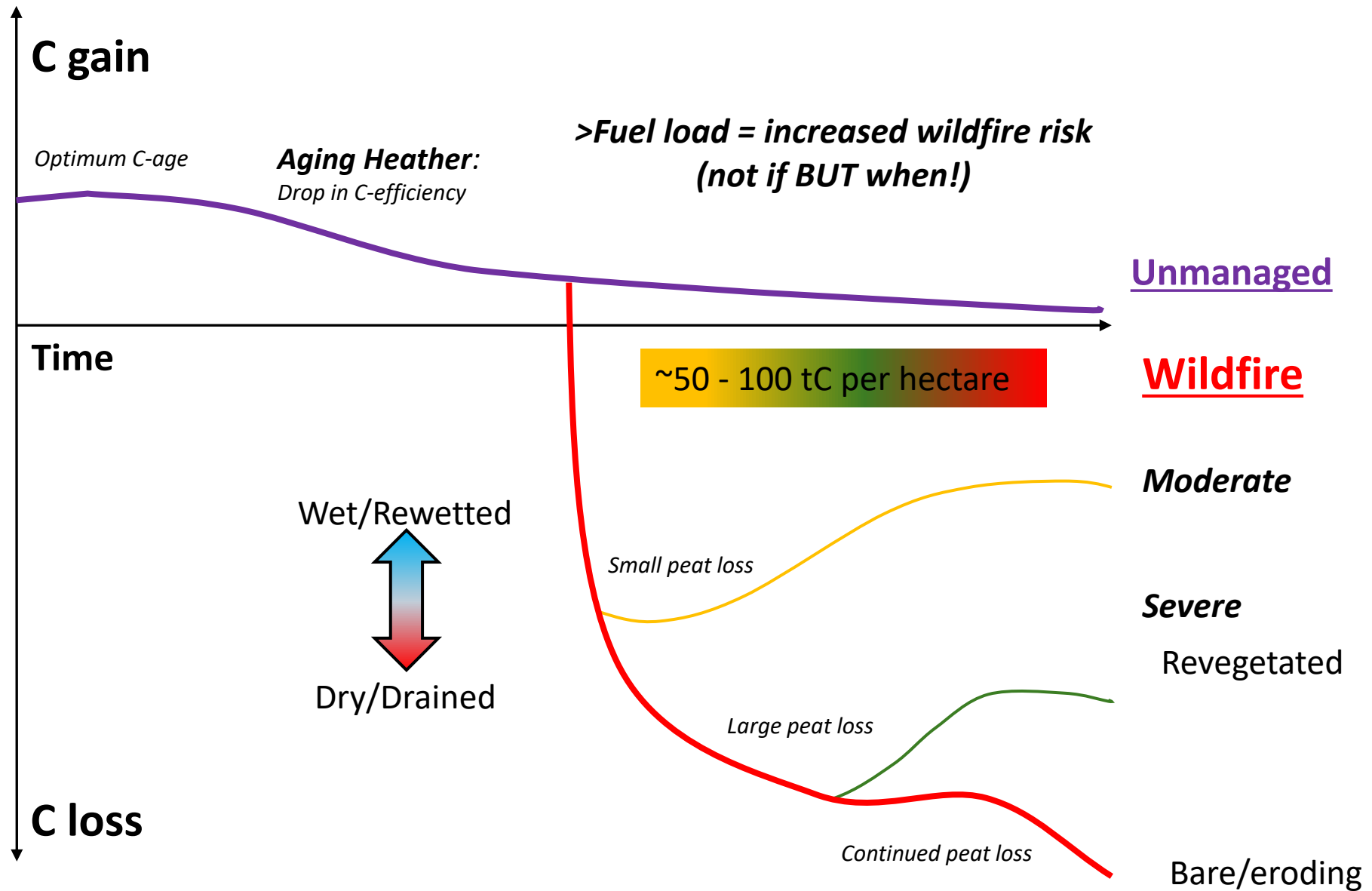
Lower water tables = **drier peat**

- Increased **decomposition**
- Declining **C sink**
- Increasing **fuel load**



Blanket bog (United Utilities)

Wildfire risk: Ideal-UK-Fire (NERC)

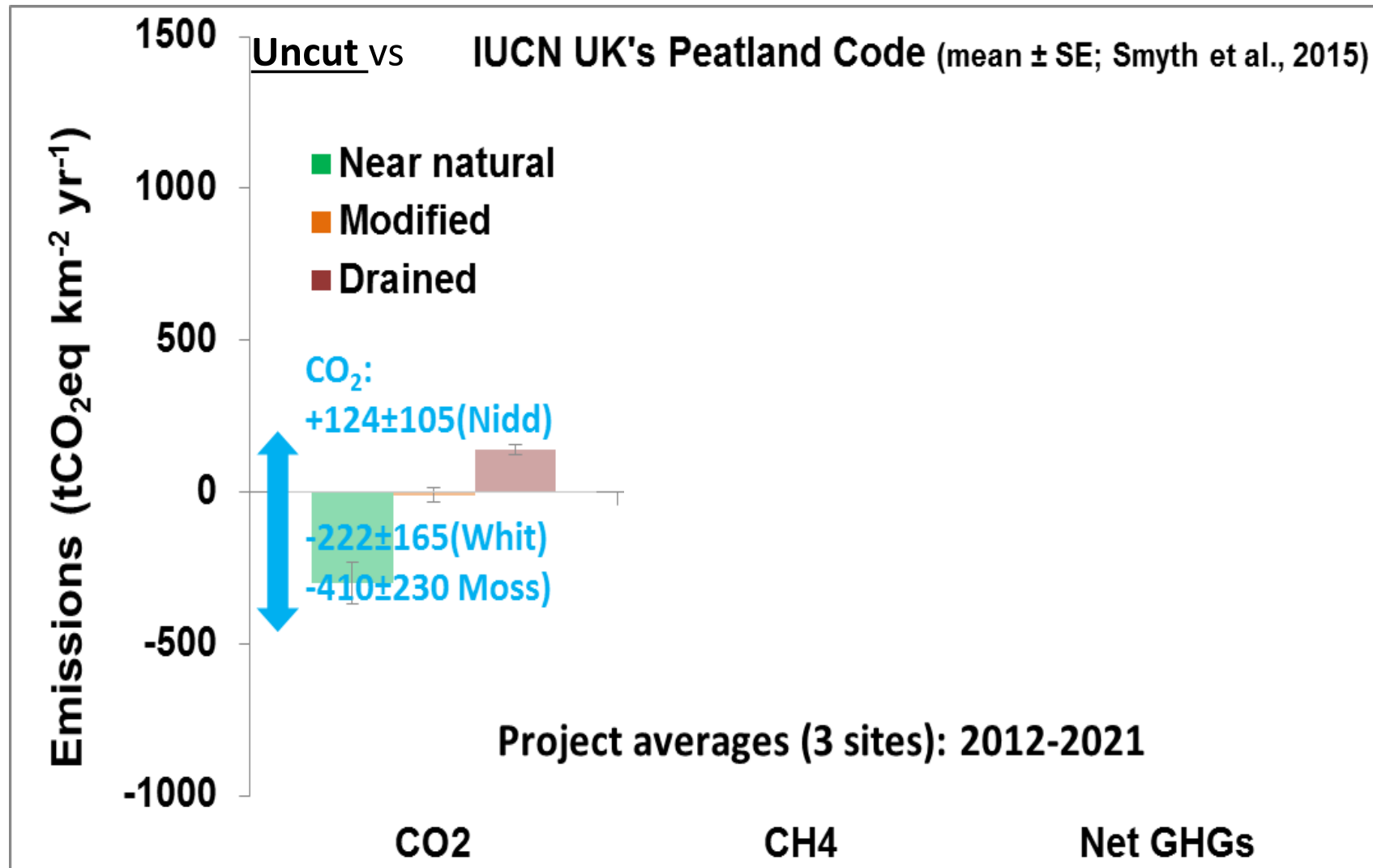


Thank you & the funders



Research Page: <https://peatland-es-uk.york.ac.uk>

GHG budgets: Peatland-ES-UK (Defra et al.)



→ **Uncut**: site variability high but similar to “Near natural” of IUCN UK !

→ No other data (heather-dominated) – importance (**emissions inventory**)!