

Plant Community Responses to Experimental Climate Manipulation in a Welsh Bog and their Paleoenvironmental Context

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LEVERHULME
TRUST

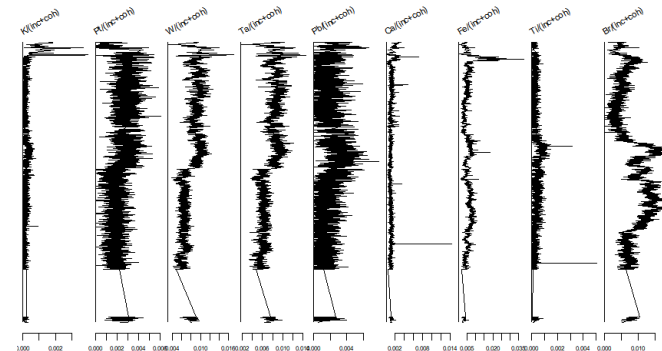


Experimental studies: manipulate climate in the lab or field and monitor ecosystem response

Paleoecological studies: study how ecosystems have responded to climate in the past

The two approaches are theoretically complementary... but rarely used together...

Results sometimes disagree!

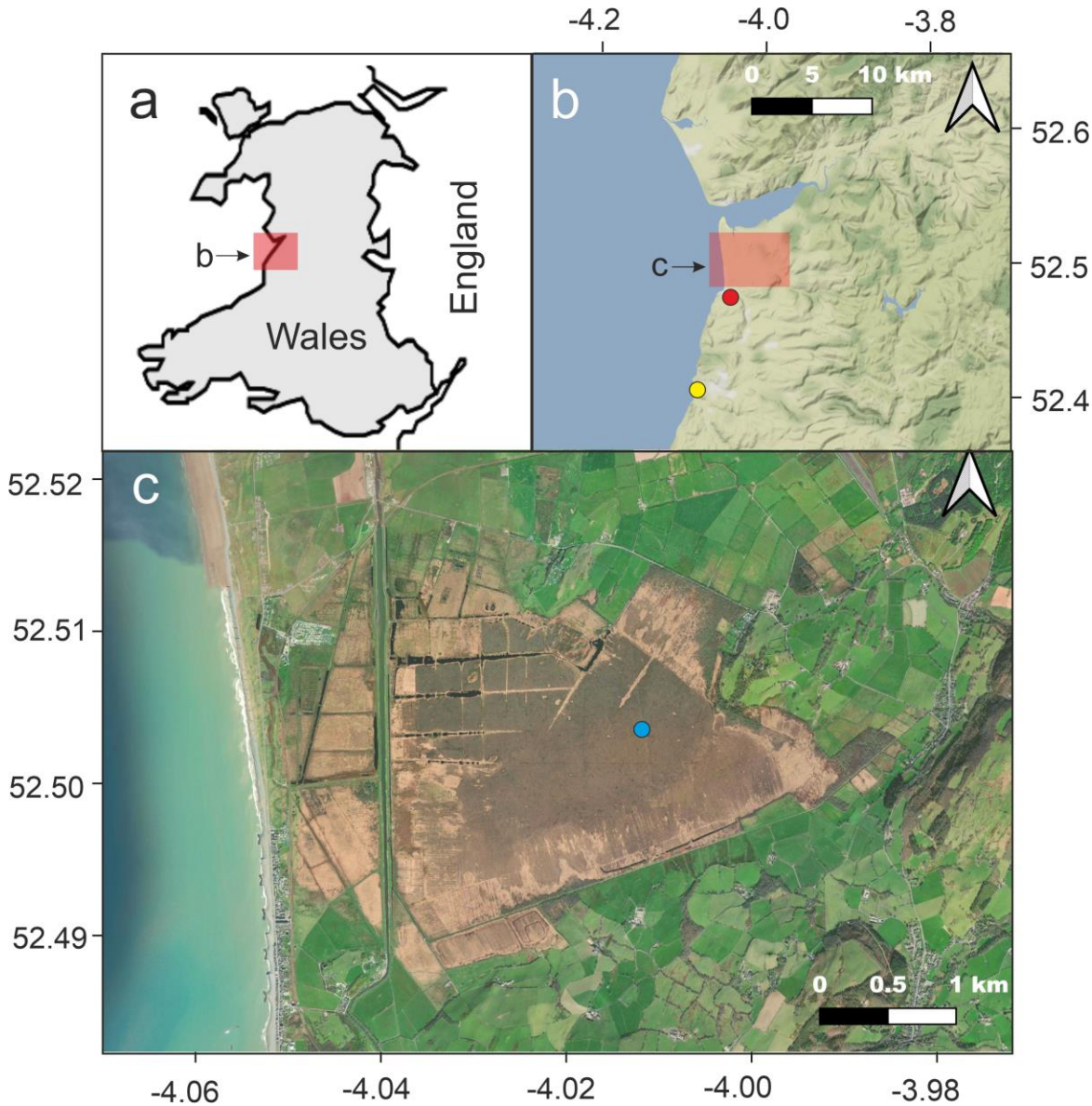


- **‘Link the past to the present’**

Compare shifts in vegetation following ten years of climate manipulation with historical vegetation response to climate, inferred from a peat core

Determine whether past shifts serve as a useful analogy for anticipating future responses to anthropogenic climate change.

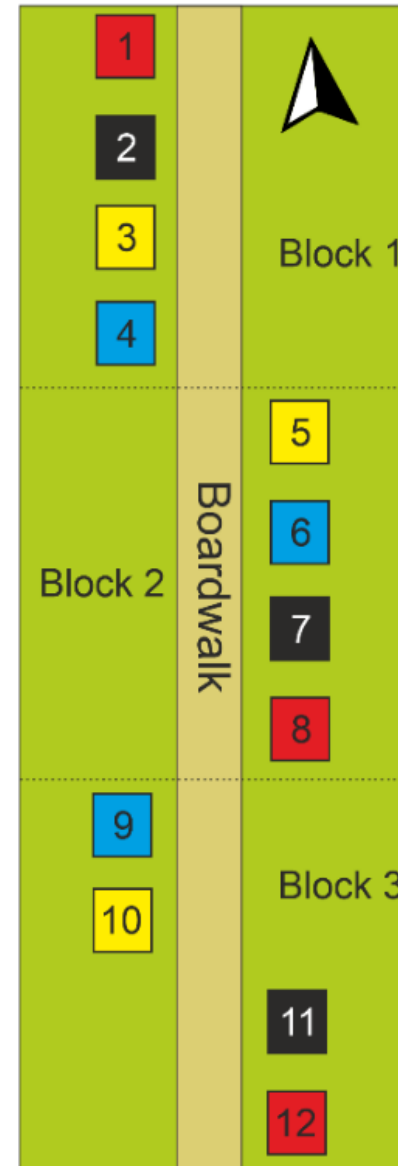
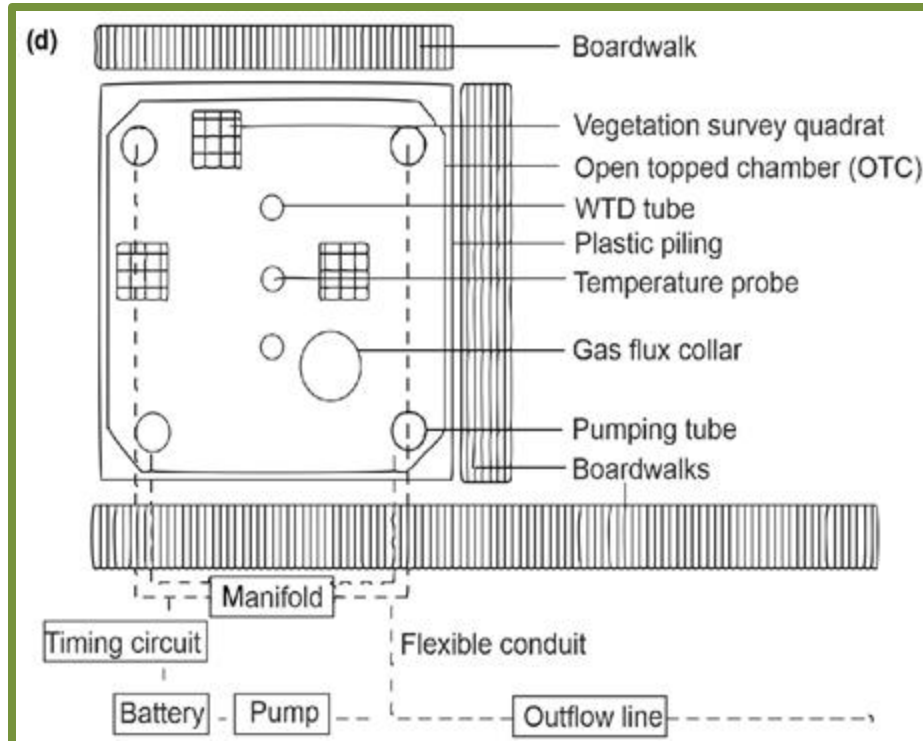
Study site: Cors Fochno, Wales



- *Sphagnum*-dominated lowland raised bog
- 2 km² central intact bog surrounded by 4 km² degraded peatland

Cors Fochno Climate Experiment

- Warming: Open Top Chambers (OTCs)
- Episodic summer drought simulation
- Combined (warmed and droughted)
- Fully-factorial, 12 plots / 3 blocks.



Treatments:

- Control
- Warmed
- Drought
- Combined

Field Experiment - Vegetation

- Annual vegetation survey: pin-touch method. 25 quadrats, 3 x quadrats per plot.



Core

1.5 m long, 5 cm diameter core extracted from the bog in November 2017. 1 cm sub-samples analysed to 100 cm for vegetation.

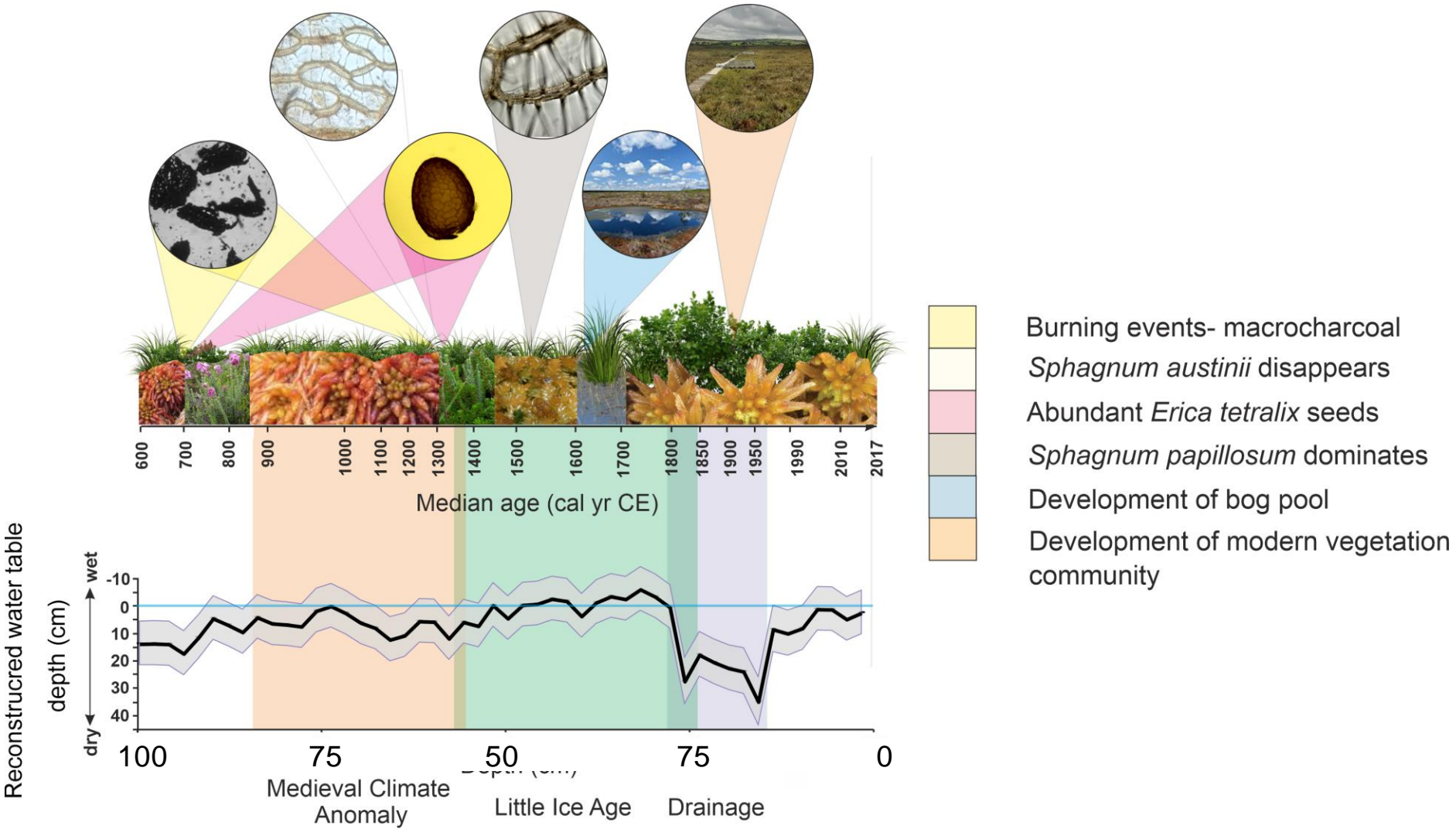


Species Composition

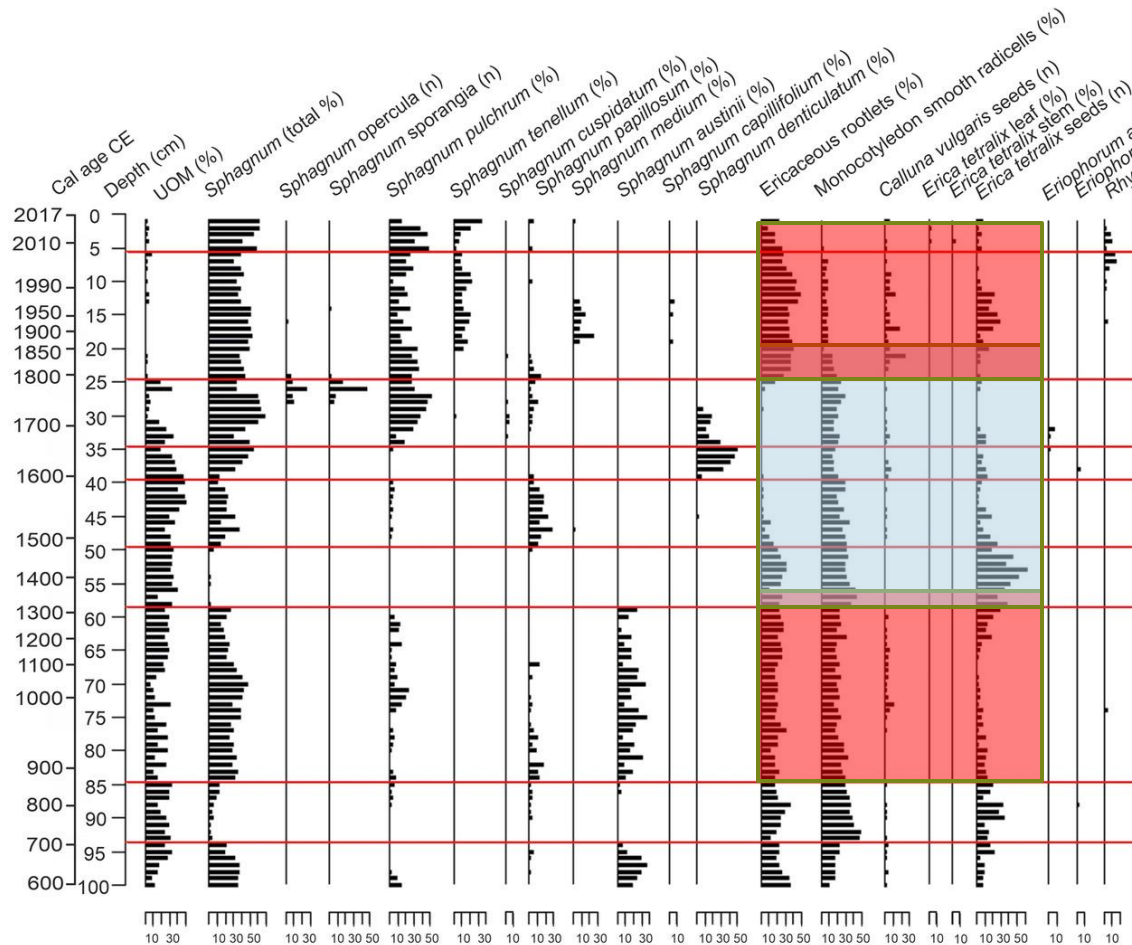
Plant remains assessed using a low-power stereomicroscope; identified to species level where possible



Core: Water Table and Climate Periods



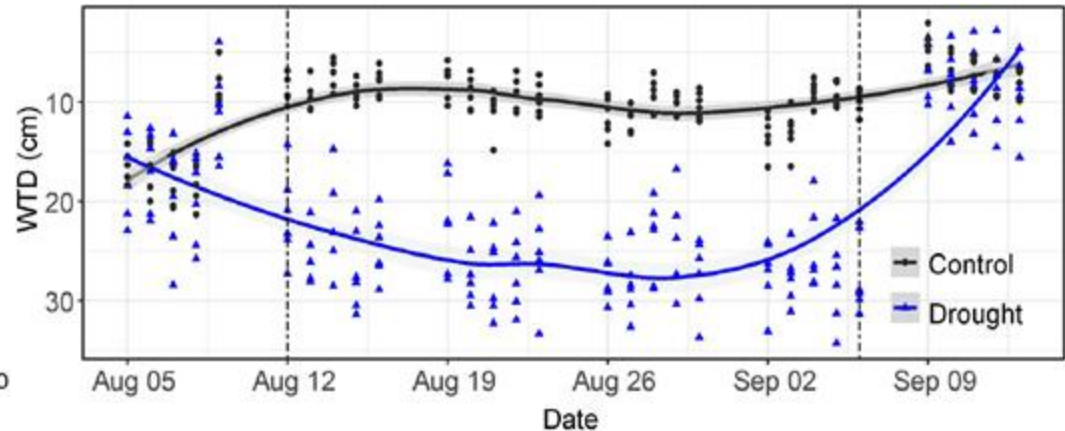
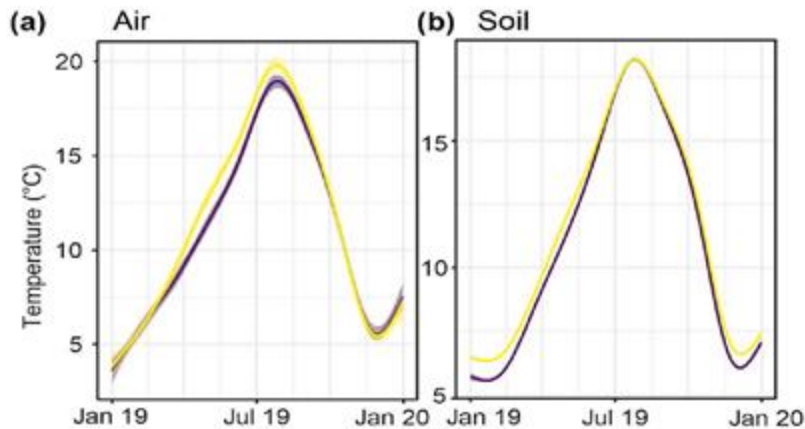
Ericaceous remains, e.g. seeds, rootlets, are more abundant during the MCA and in recent history than during the LIA. *Erica tetralix* seeds increase in response to fire



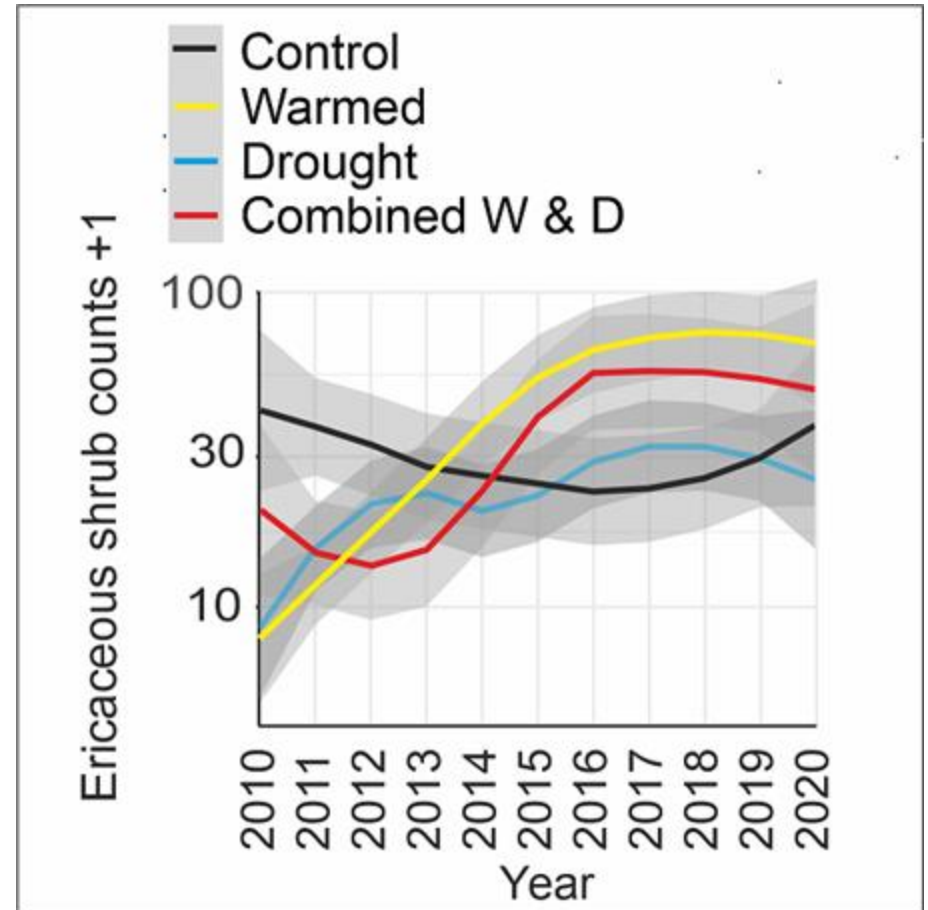
Experimental Warming and Drought

Warming: 0.5° C mean temperature elevation in OTCs; + 7° C in summer

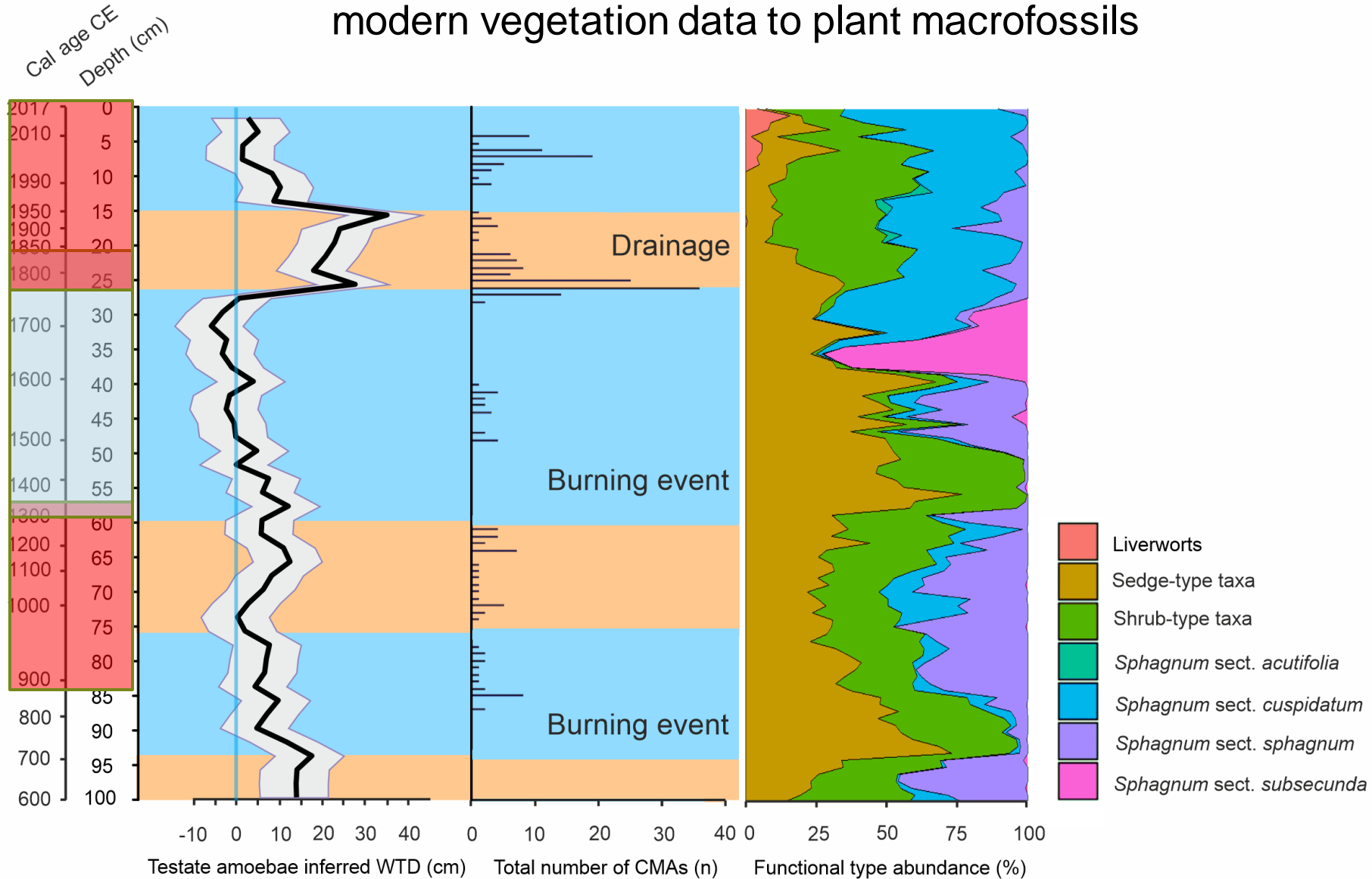
Drought: 15 cm mean lower water table in drought plots



- No (significant) changes in individual species
- Significant (but not huge) increase in shrub cover in warmed and combined treatment plots
- No effect of drought
- No change in *Sphagnum* abundance under any treatment



CMA: Closest Modern Analogues. Directly compare modern vegetation data to plant macrofossils



Take-home messages

Field experiments and paleoecological reconstructions focus on different response times and controls.

Together they can provide a more complete picture of peatland response to climate change than either method alone.

It is important to acknowledge that past impacts have influenced modern vegetation communities, and therefore present day ecosystem functioning

- Funders: Leverhulme Trust, Ecological Continuity Trust
- Natural Resources Wales
- Numerous students, spouses etc.
- Jon and Jane of the Borth YHA

Questions?



**Cyfoeth
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