



The Great Fuel Moisture Survey

Developing fundamental wildfire science and sustainable community owned agency in traditionally non-fire prone societies

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Grand Challenge:

Temperate regions facing emerging wildfire threat for which we lack the necessary:

- Scientific knowledge of the threat posed
- Community agency to mitigate and adapt





Fuel moisture importance

Critical factor determining wildfire risk

Key component of wildfire danger rating systems

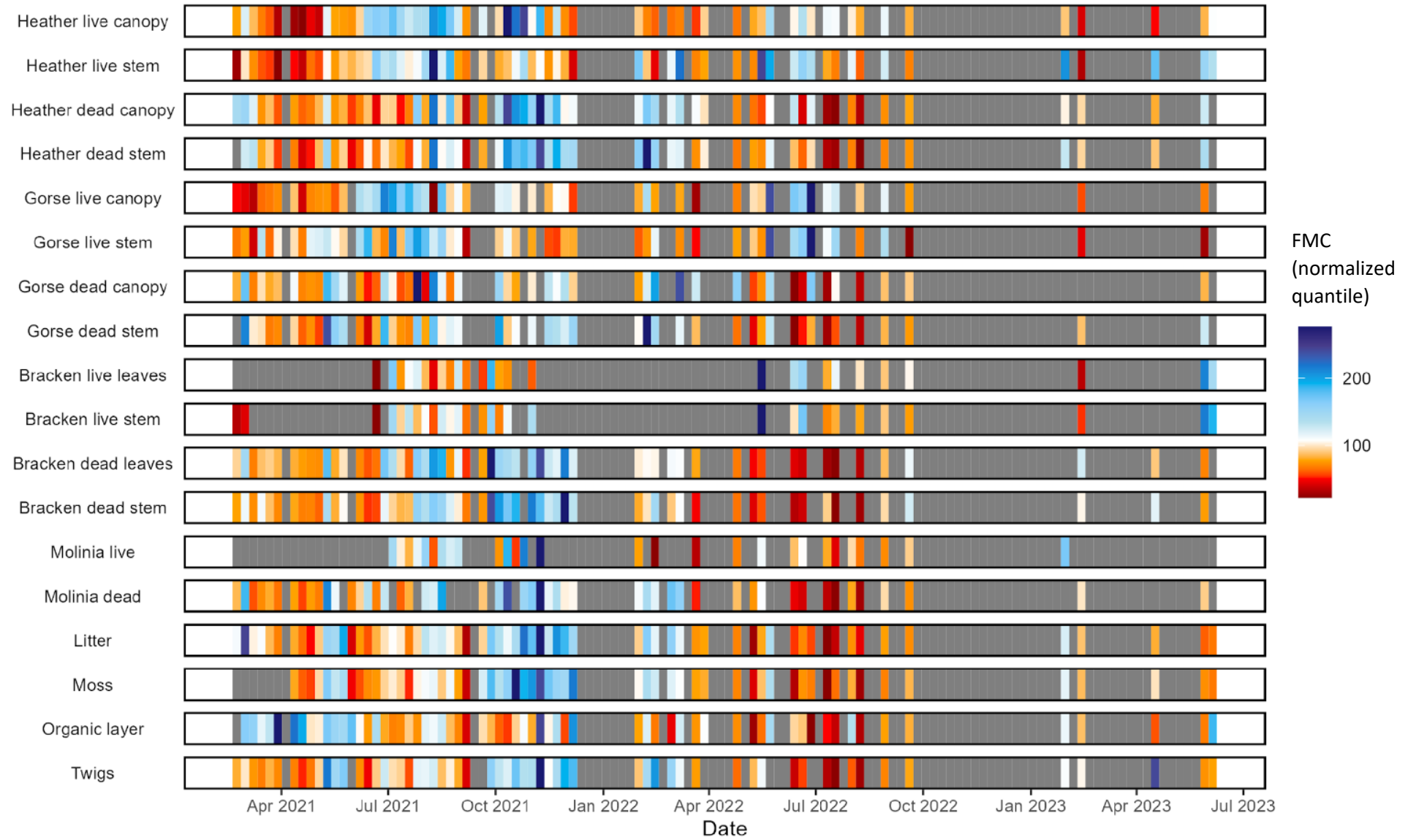
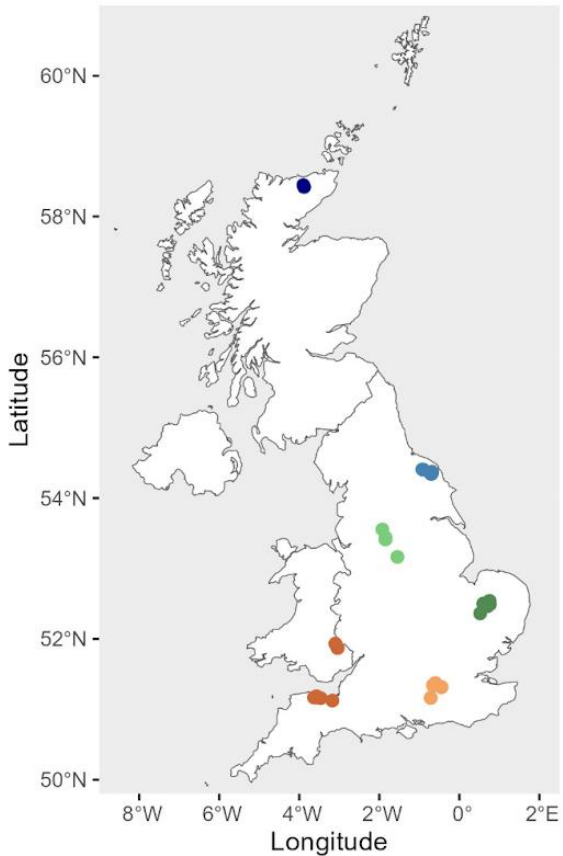
Impacts:

- Fuel flammability
- Wildfire ignition
- Fire behaviour

Time consuming to measure



Traditional methods



Traditional methods

WEATHER

- Mean temp on day of sampling
- Mean humidity on day of sampling
- Rainfall from 5 days before sampling
- Number of days since last rainfall
- Wind speed

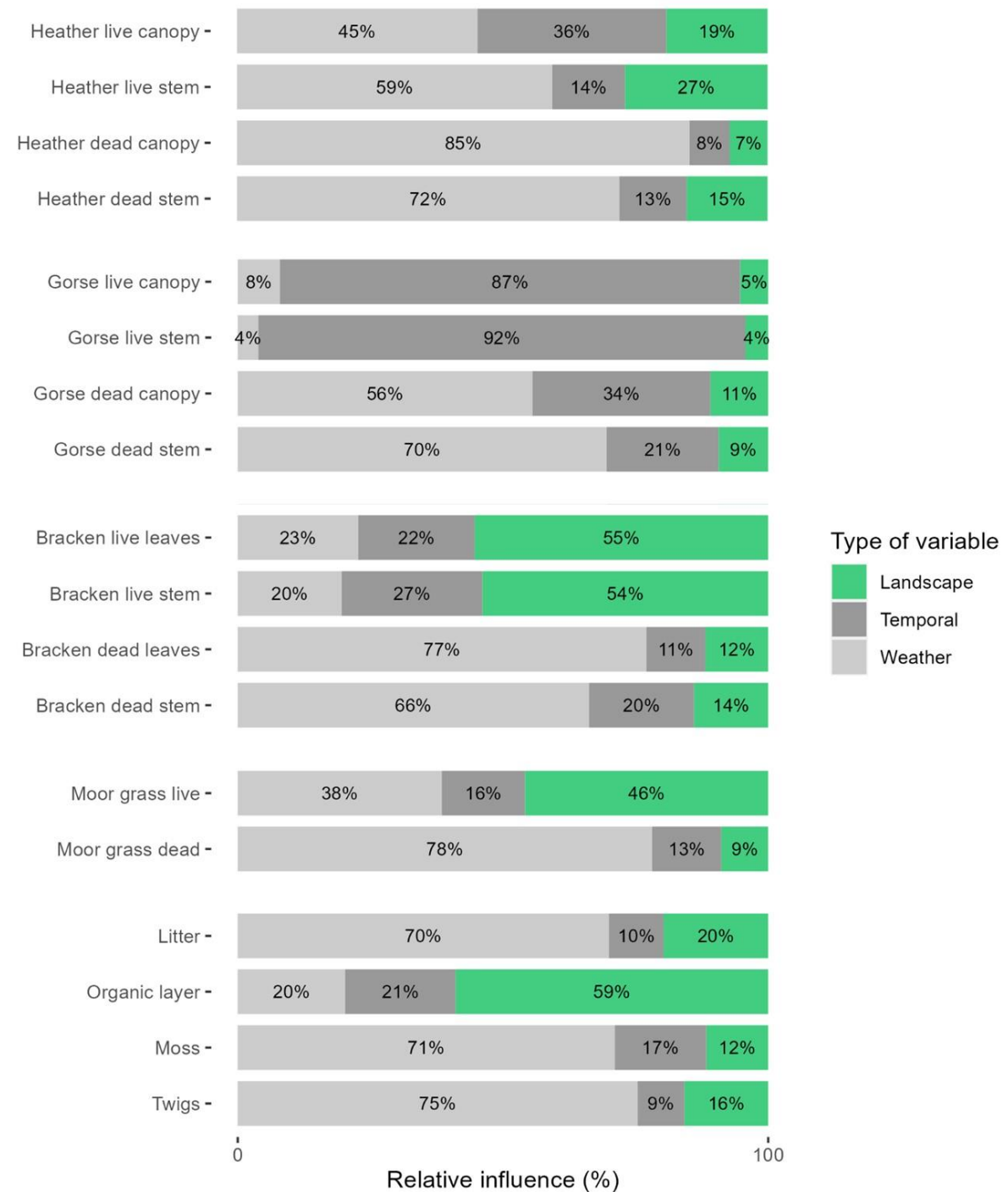
LANDSCAPE

- Land cover type
- Soil type
- Region of UK
- Elevation
- Slope
- Aspect

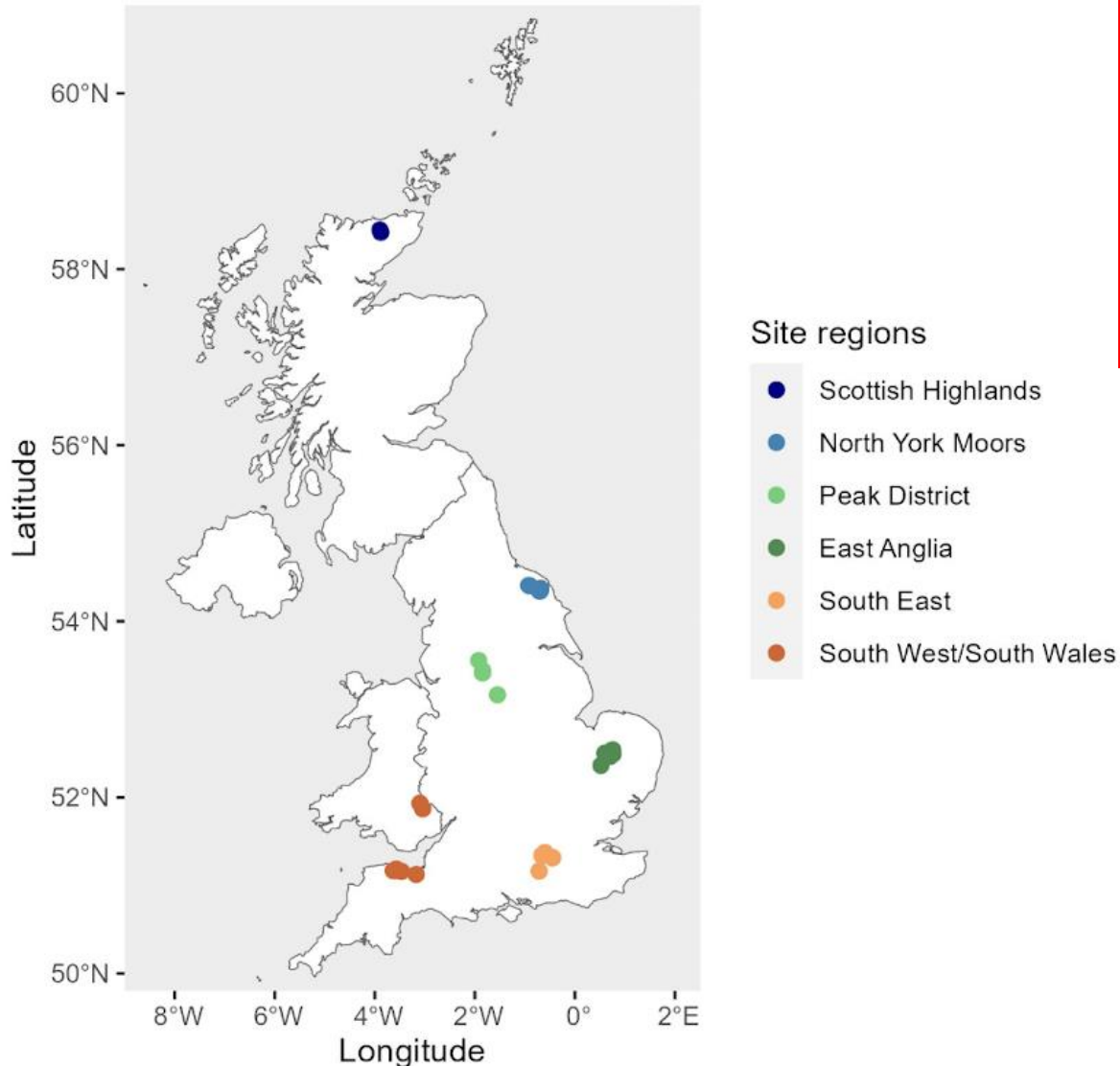
TEMPORAL

- NDVI
- Green Chromatic Coordinate
- Sample year
- Time sampled

Iverson et al., 2024 In Review, Landscape factors can improve the predictive ability of fuel moisture models for assessing wildfire risk



Opportunities and limitations of traditional methods?



Poster session:

Extreme weather breaks phenological and landscape controls on temperate peatland fuel moisture; implications for carbon stock release through changing wildfire regimes

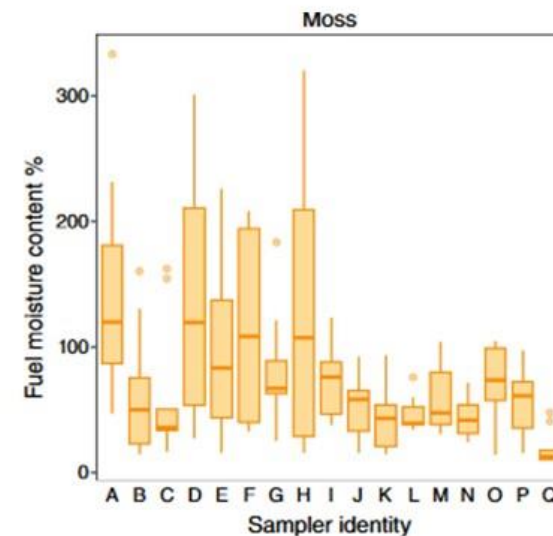
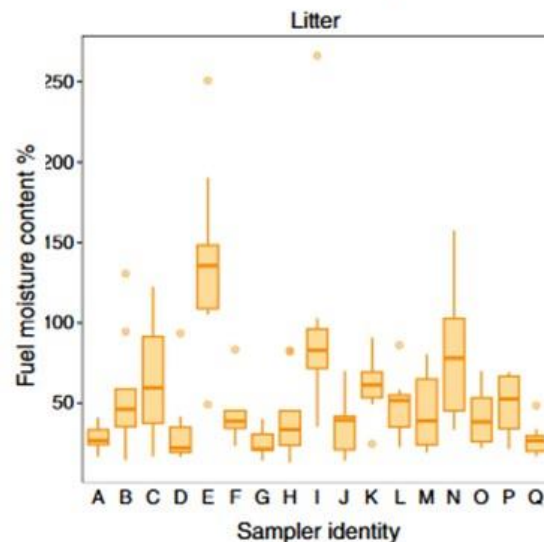
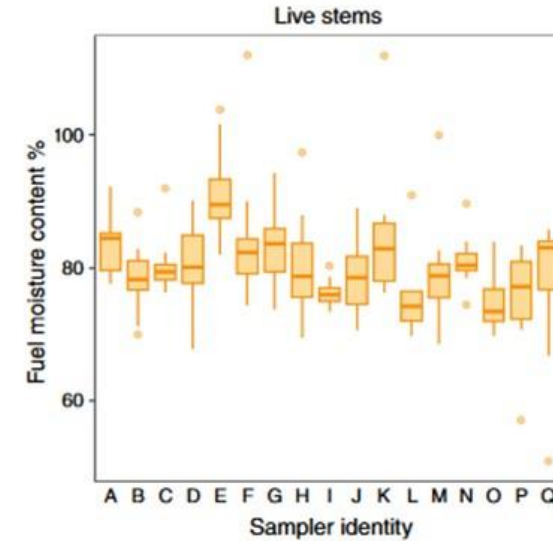
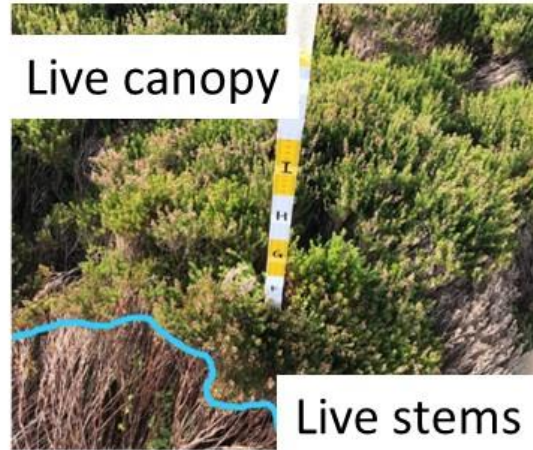
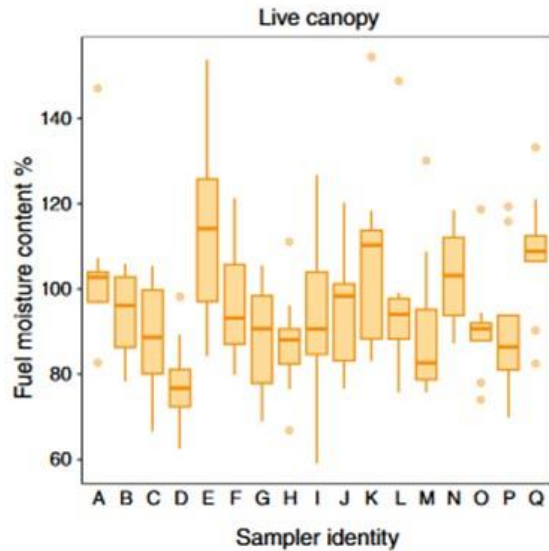
Katy Ivison, University of Birmingham

What controls the spatial variation in fuel moisture under periods of high fire danger?

Citizen Science: Collecting large amounts of spatially variable fuel moisture and flammability **data over short time periods** of high fire danger

Citizen science, an effective and valuable method?

Sampler variability



Little et al., 2023
*International
Journal of
Wildland Fire*



The Great Fuel Moisture Survey

Working towards a tailored UK fire danger rating system

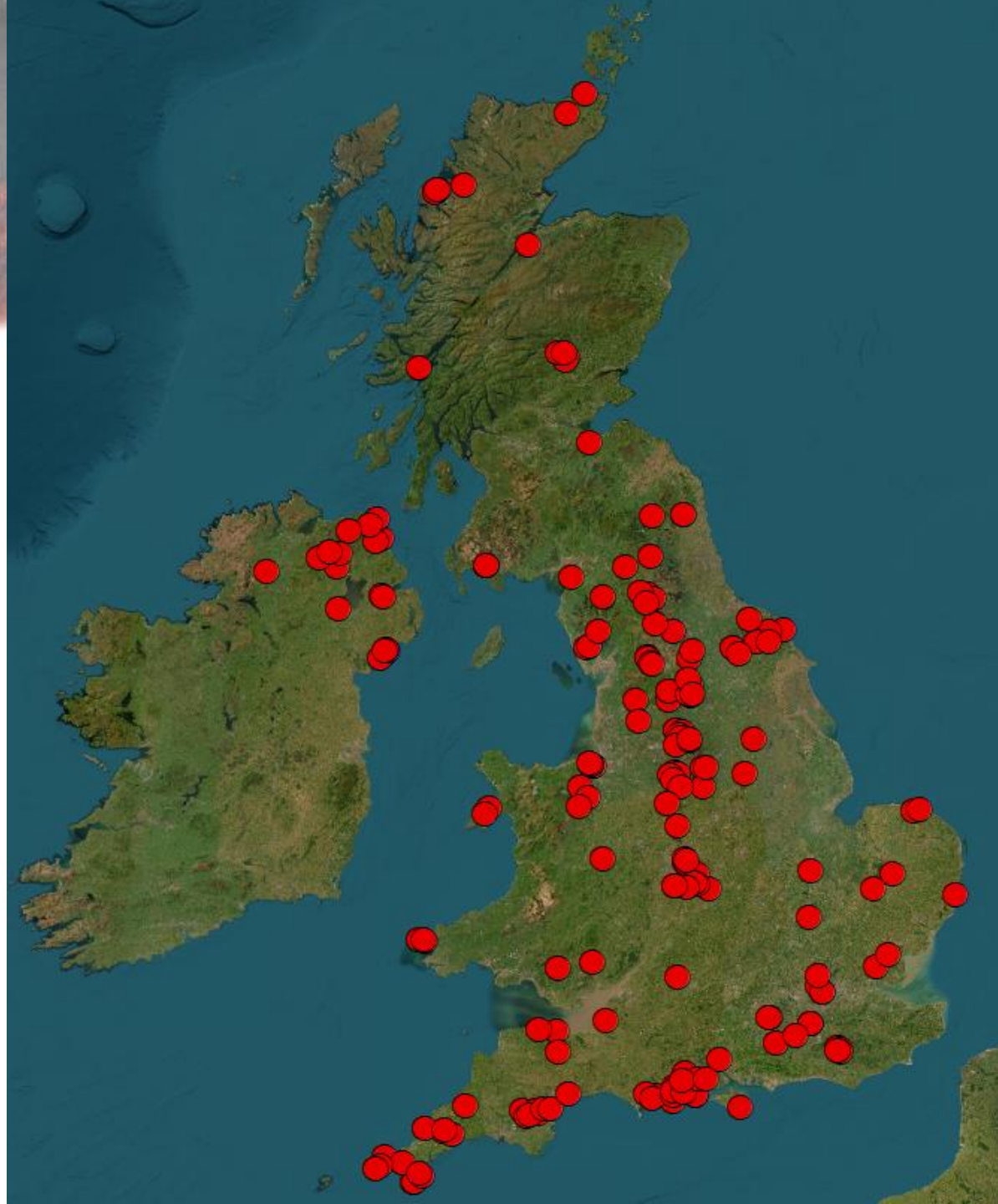
Are you able to spare a small amount of your time one day in the spring of 2023 to collect samples of heather (*Calluna vulgaris*) in your local heathlands and peatlands to support research working towards the development of a UK fire danger rating system? If so, then please see further details below.

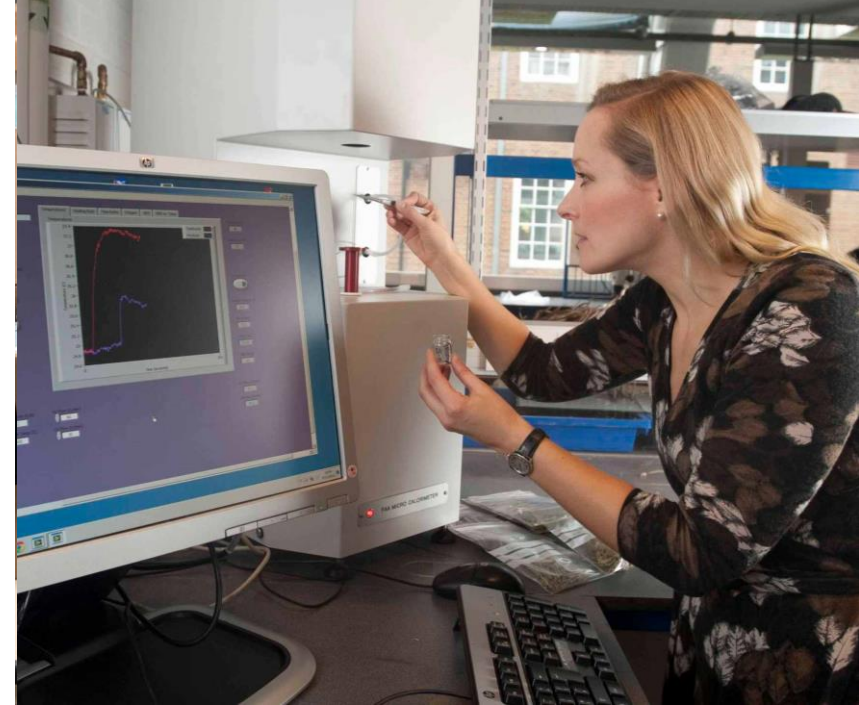
The UK routinely experiences [wildfires](#), typically in spring and mid/late summer, though winter wildfires do occur. In recent years, large-scale wildfire events in the UK have led to heightened concern in their behaviour and impacts.

As part of a £2.4 M project funded by the UK's Natural Environment Research Council, we are addressing the concern posed by such wildfires. The [project](#) aims to establish and test the scientific underpinning and key components required to build an effective, tailored UK fire danger rating system.

Wildfire occurrence is strongly dependent on vegetation moisture, which is dependent on weather, species, seasonality, soil, among other controls. However, there is limited information about how the moisture of these fuels varies in time and space in the UK.

As part of this work, we have been monitoring a fuel moisture [network](#) across the country, measuring vegetation moisture since the start of 2021. We are aiming to

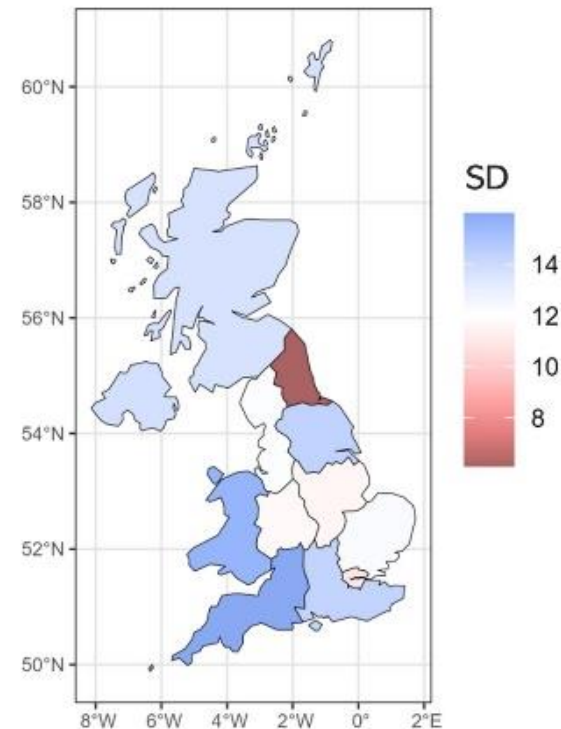
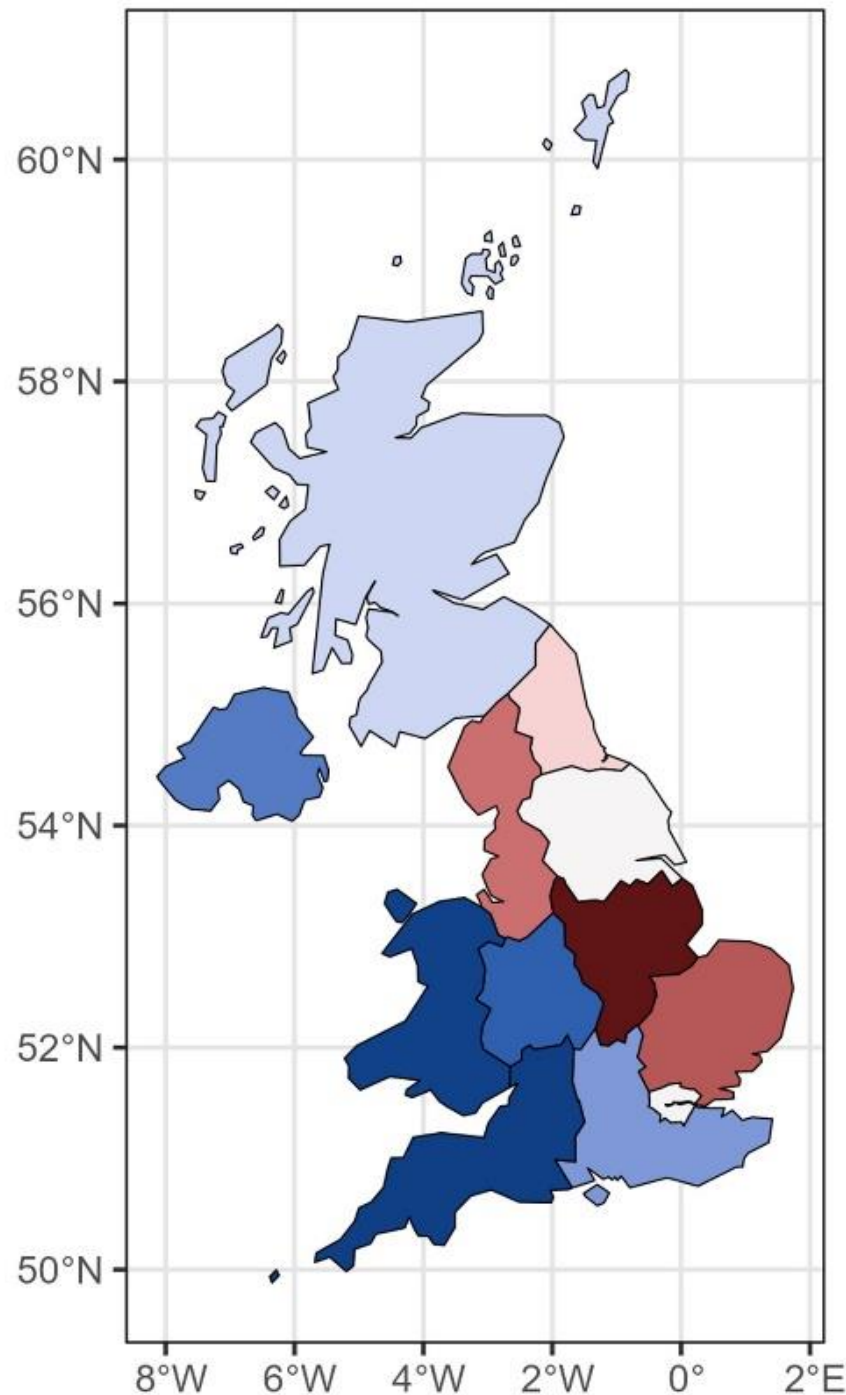
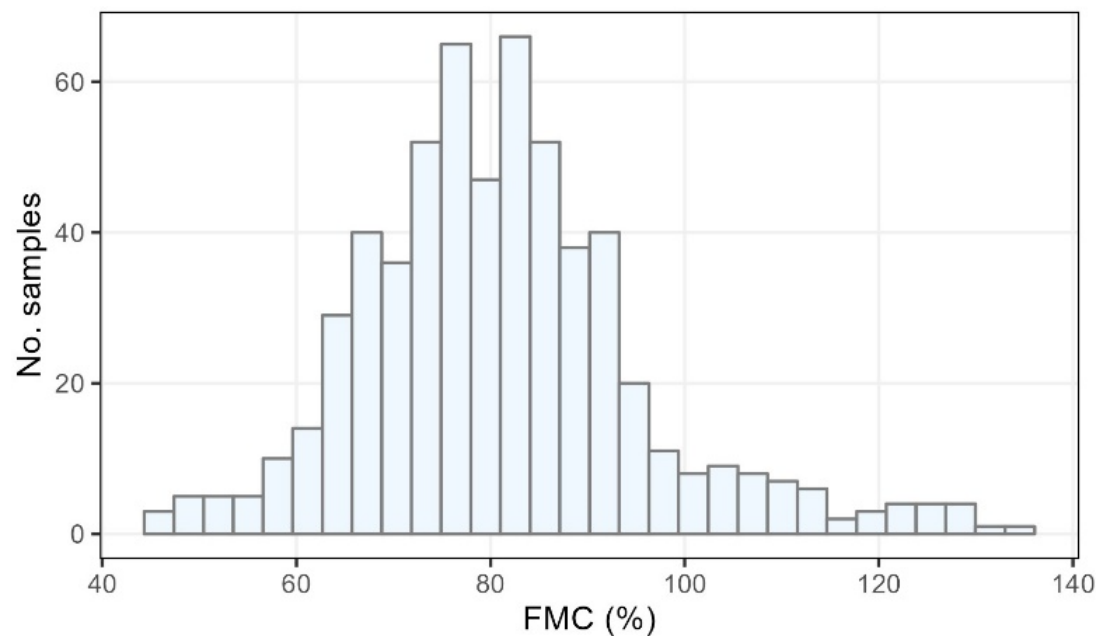




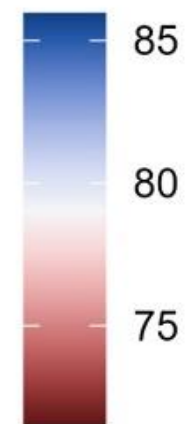


Fuel moisture

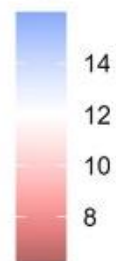
- FMC ranged from 45% to 133%
- East Midlands, East of England and the North-West had significantly lower FMC than some other regions



Mean FMC (%)



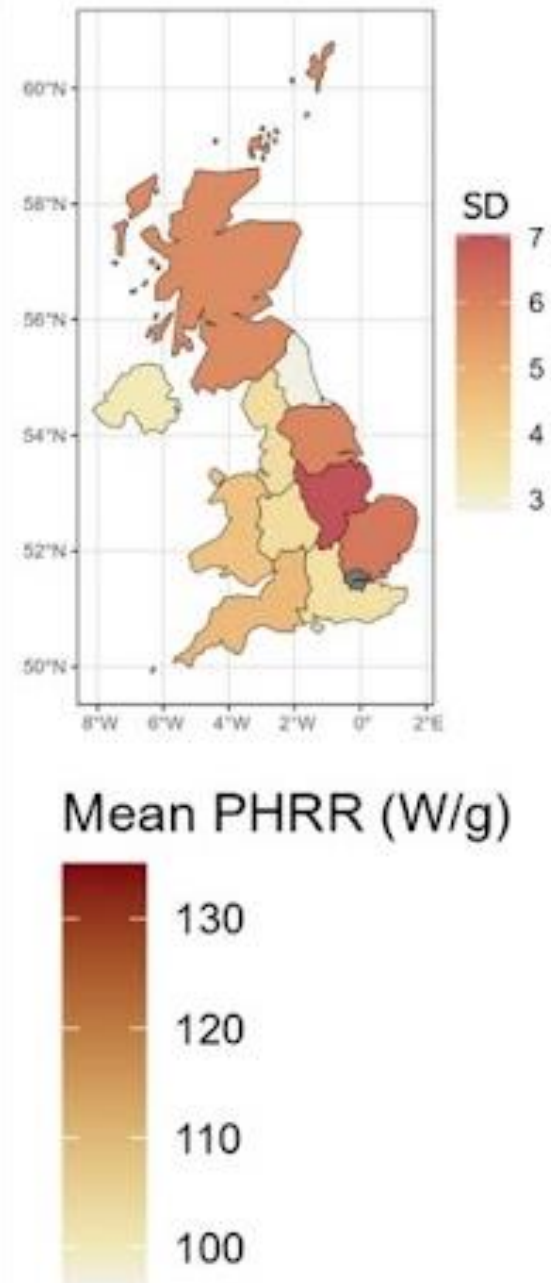
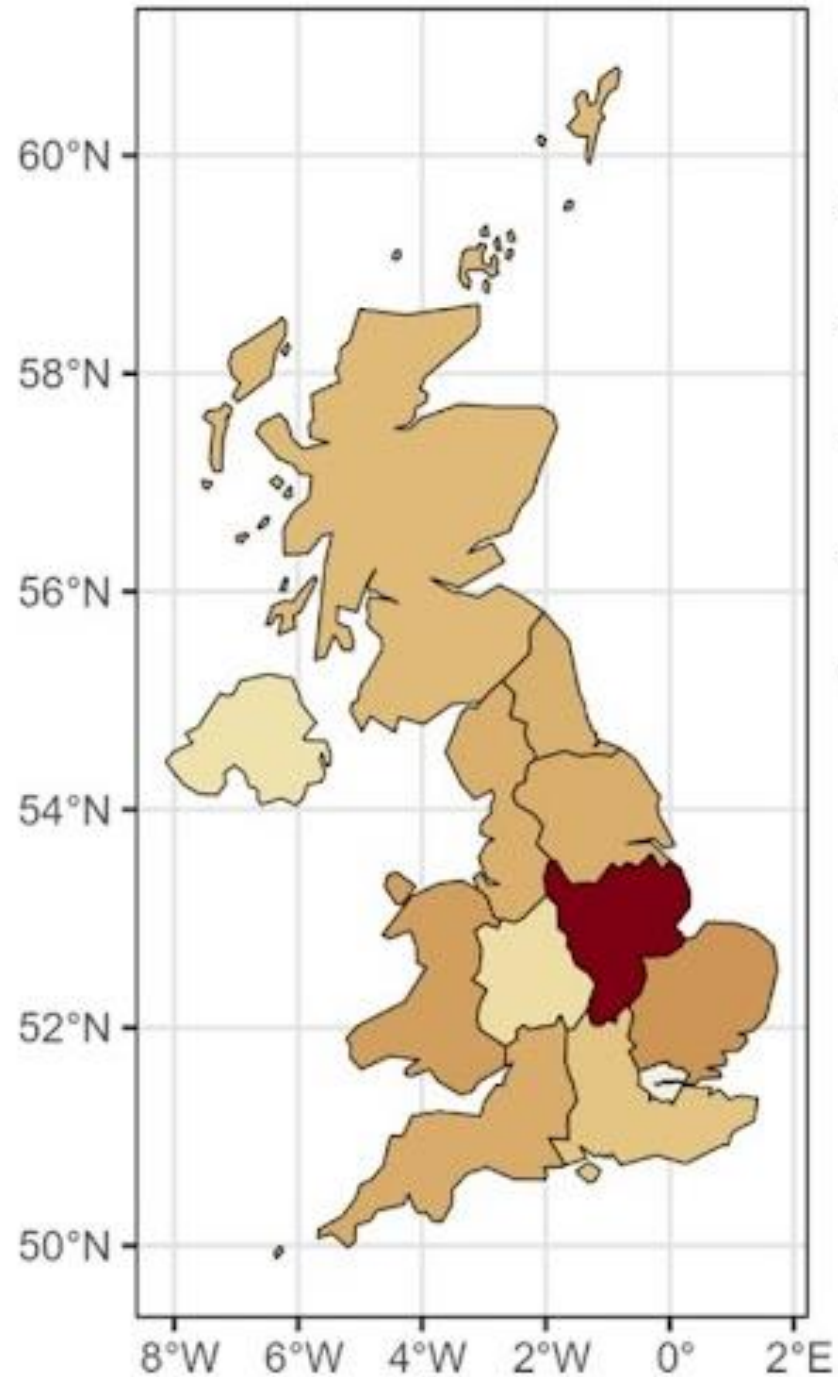
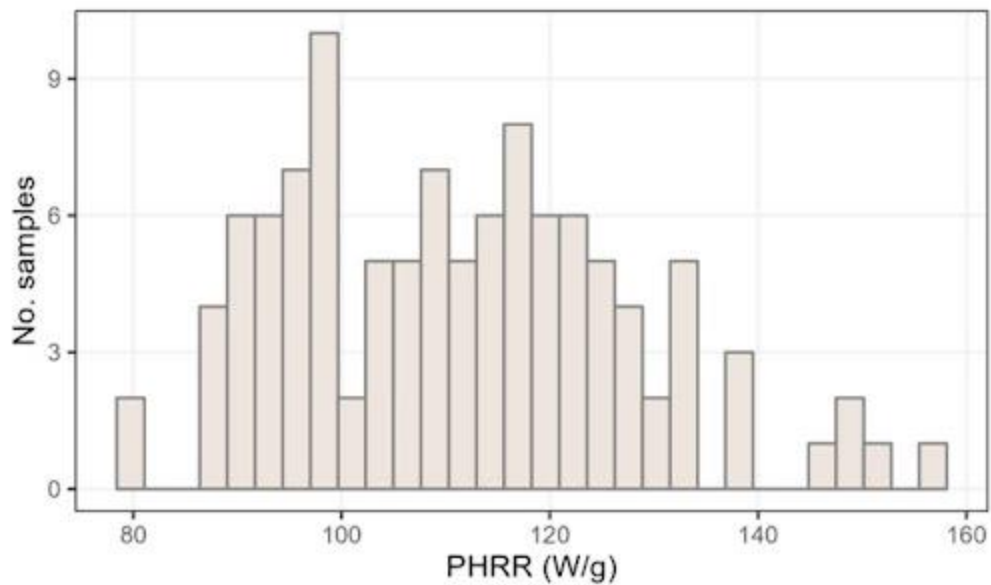
SD





Peak heat release

- Peak heat release rate ranged from 79 to 157 W/g
- No clear regional differences observed.





Analysis approach

- Boosted regression trees
- Machine learning tool to analyse which factors have the greatest influence on response variable (moisture content)
- Variables:

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- Mean temp on day of sampling
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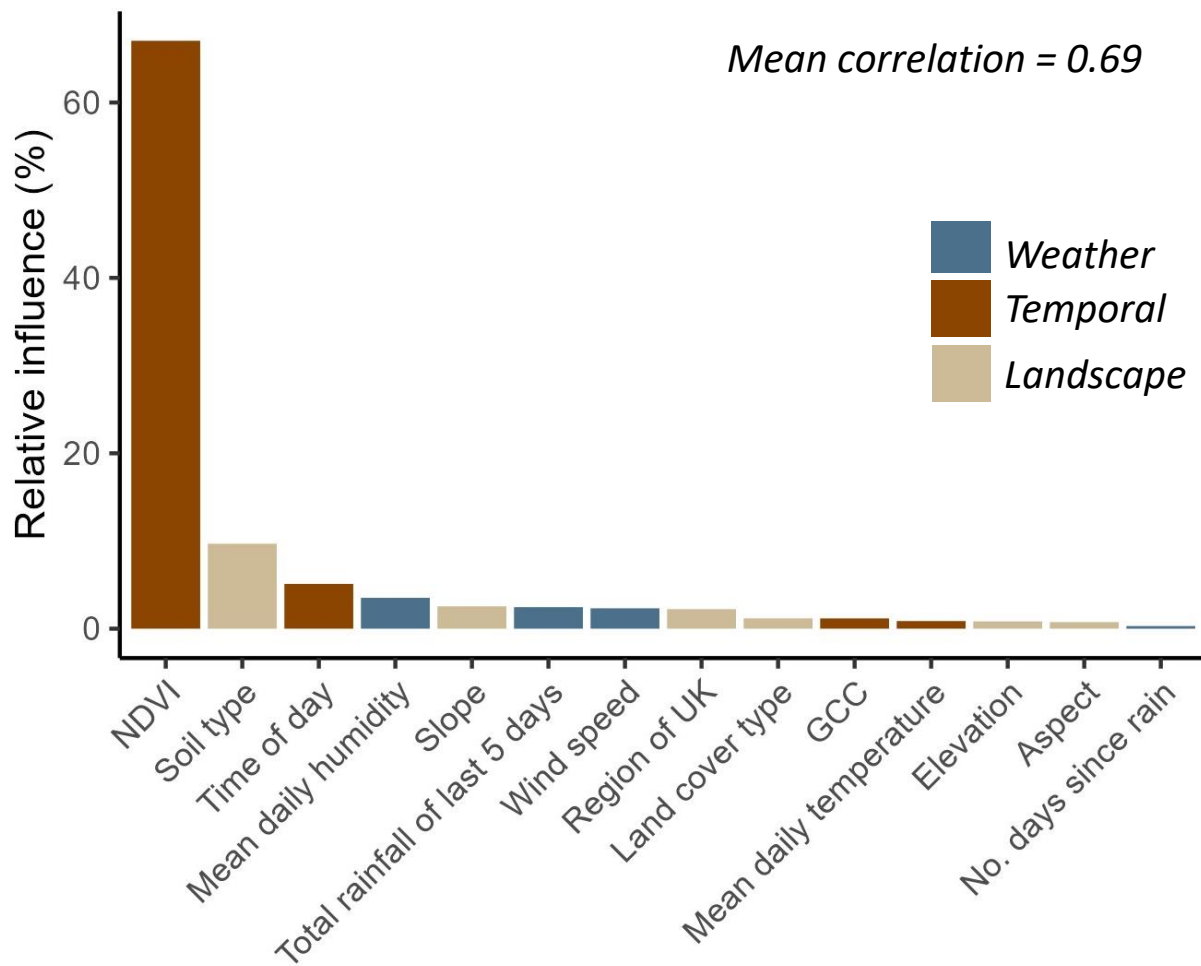
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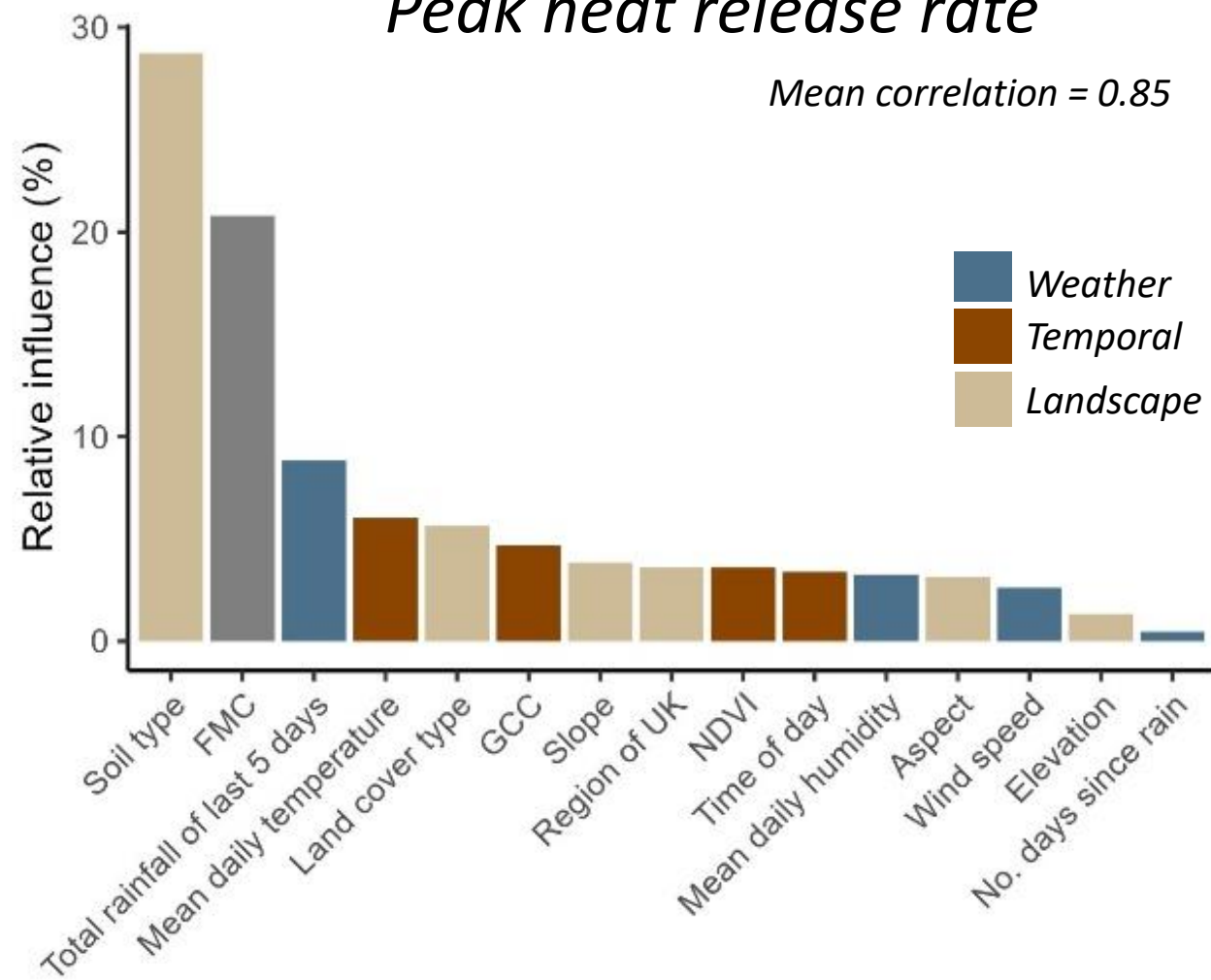


Boosted regression tree

Fuel moisture content



Peak heat release rate





Building a wildfire aware community

- Wildfire threat cannot be addressed by science alone
- Non-fire prone regions need change in public awareness
- Tool to energise and motivate communities in wildfire risk reduction?
- Encourages communities to explore their local landscape through a wildfire lens?
- Empowering communities with the knowledge and motivation to make informed, local decisions.

Huge thank you to the ~150 volunteers who contributed to this work





Additional slides



Plot scale - Sampler bias

Fuel layer	Coefficient of variation	Explained by time of day R ² %	Explained by sampler bias R ² %
live canopy	0.07	17.92	19.17
live stems	0.04	13.00	19.82
dead canopy	0.04	13.06	1.27
dead stems	0.10	1.75	3.9
moss A	0.20	0.07	6.9
moss B	0.21	10.27	26.41
litter	0.48	2.04	44.08
organic A	0.08	2.10	5.52
organic B	0.23	1.38	33.85

mixed effect model with time as a quadratic fixed effect term and sampler identity as a random effect

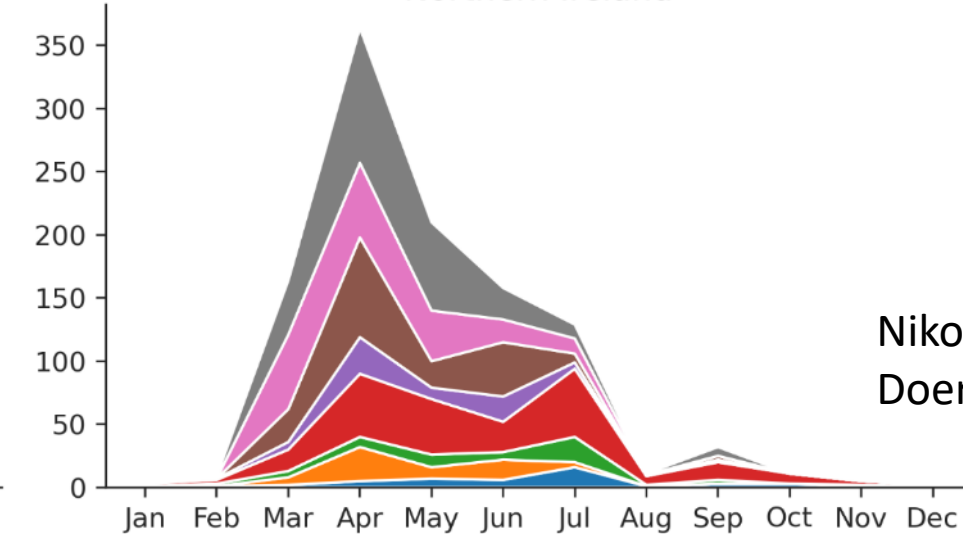
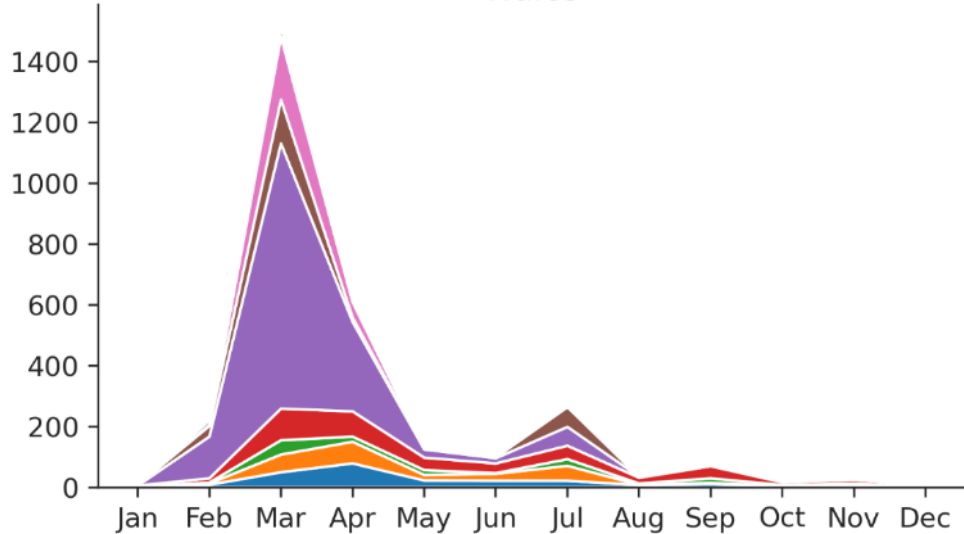
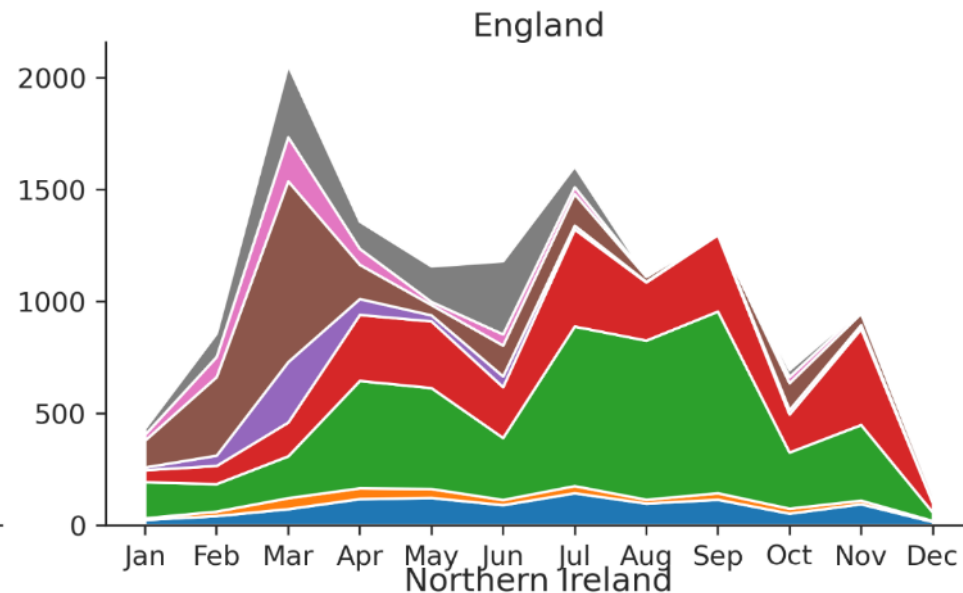
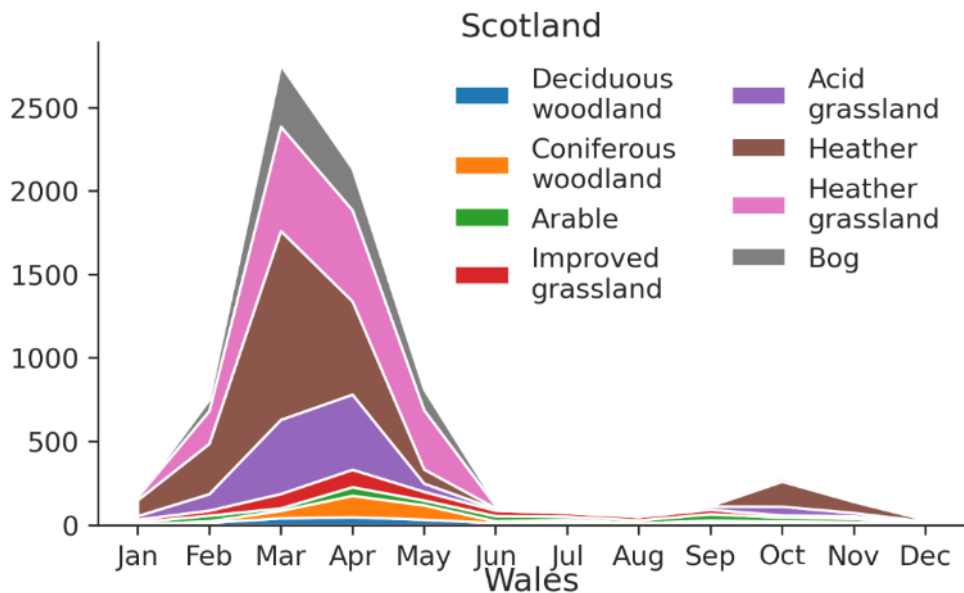
- Sampler difference often greater than impacts of time of day
- Bias varies considerably between fuel layers





UK fire seasons

Fire detections per month and CEH land cover types, VIIRS record (2012-2022/7/29)



Nikonovas and Doerr (in prep)



Importance of fuel moisture content

Fuel moisture is a critical factor determining wildfire risk and a key component of wildfire danger rating system



UKFD RS

Important for:

- Fuel flammability
- Wildfire ignition
- Fire behaviour

