

Towards a UK Fire Danger Rating System: Developing tools for a resilient future

UK Wildfire Conference 13 November 2024

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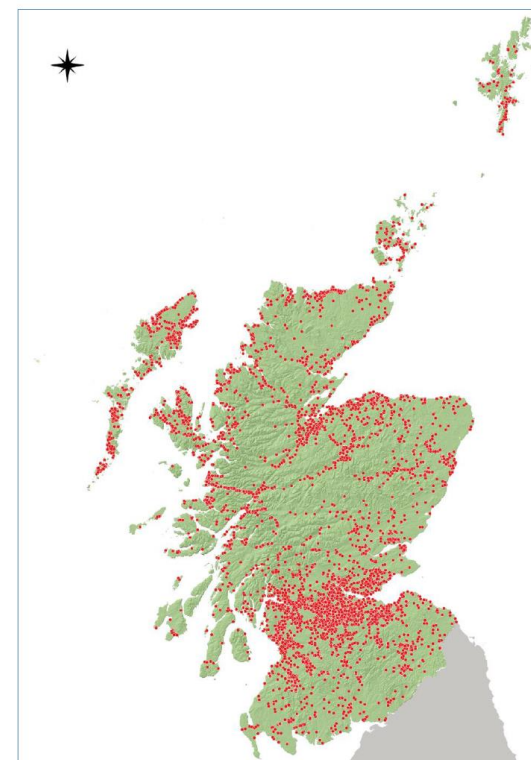
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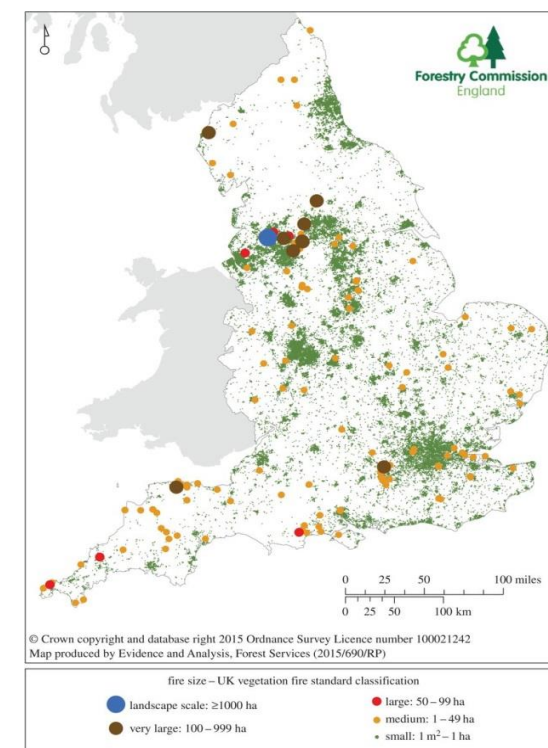


UK fire regime

- The UK has a **complex fire regime**, including management burning and episodic wildfires.
- In addition, a mix of land cover types and a diverse rural-urban interface means there are **distinct fire challenges**:
 - human life and property
 - land assets and ecological disturbances.



Wildfires on Incident Recording System (IRS)
1st Apr 2009 – 31st Dec 2020.
From [Gagas et al. \(2022\)](#)

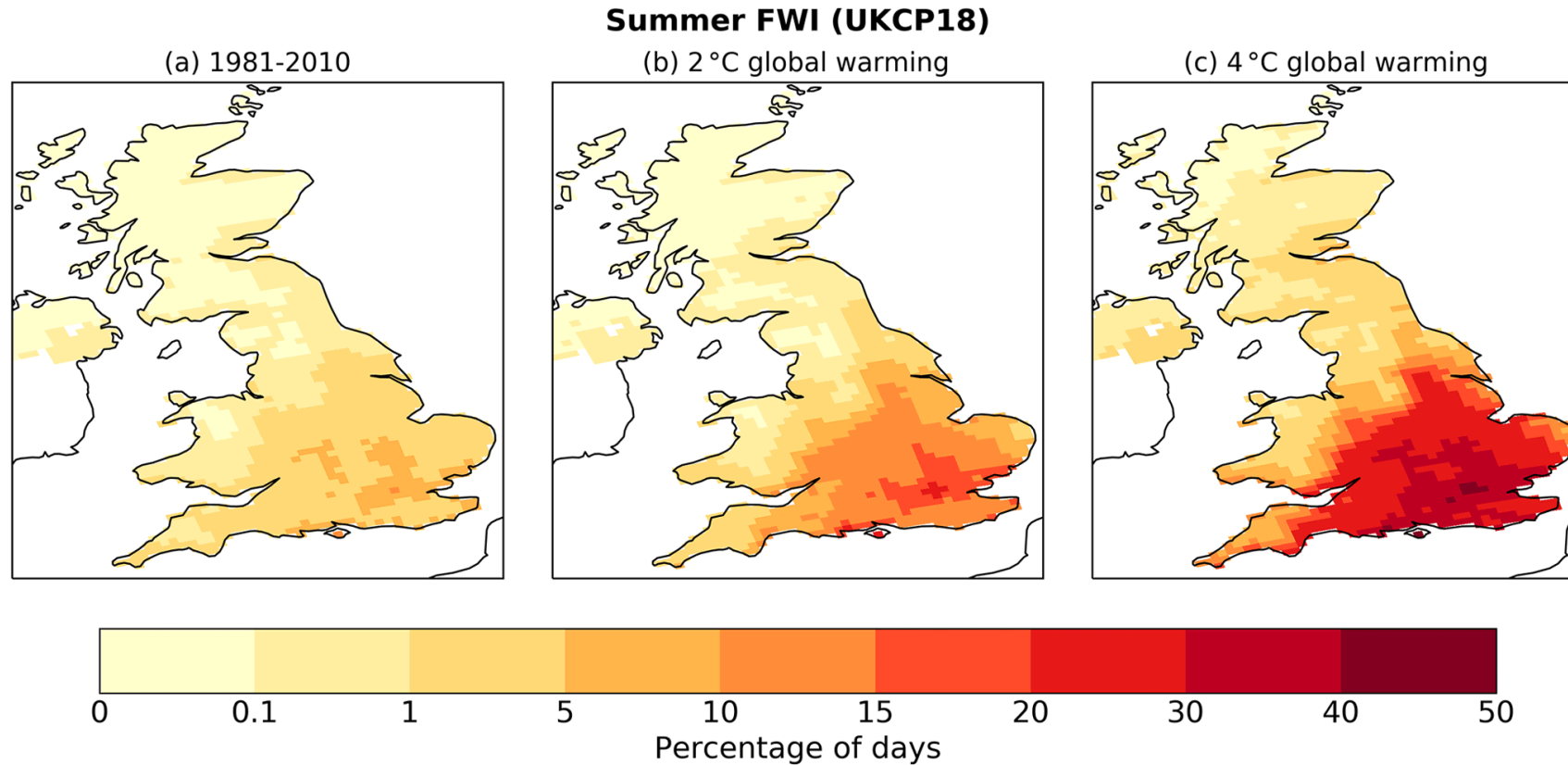


Vegetation fires in England (1 Apr 2011 – 31 Mar 2012) from [Gazzard et al. \(2016\)](#)





Our wildfire future?



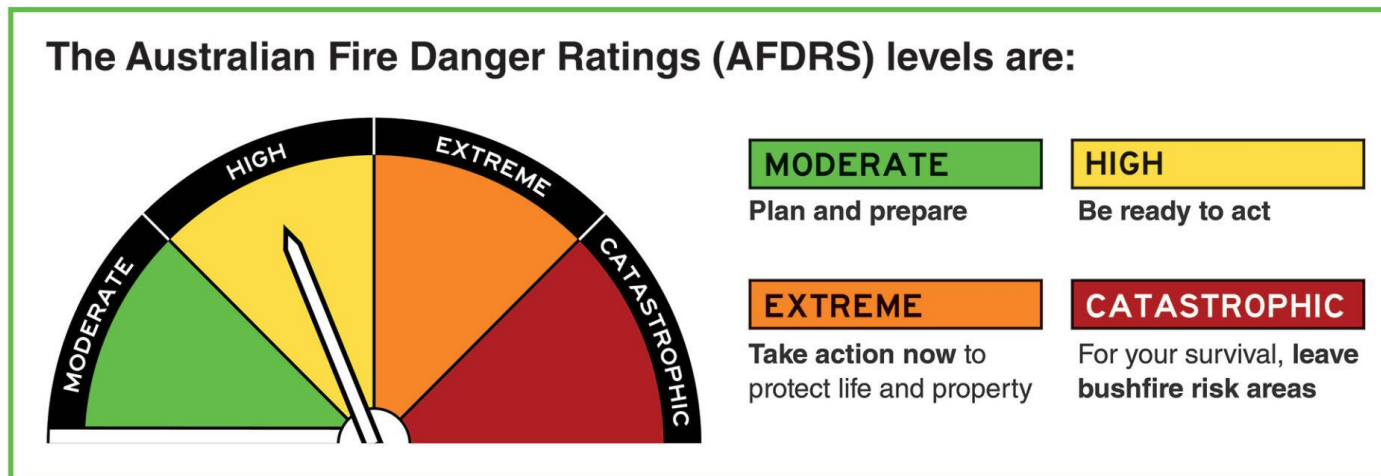
From [Perry et al. \(2022\)](#)

Percentage of summer days with very high fire danger (FWI > 17.35) over the UK, based on the UKCP18 12 km data averaged over the 12 ensemble members. **(a)** Historical period (1981–2010), **(b)** 2 °C global warming and **(c)** 4 °C global warming.



Fire danger rating systems

- Fire danger is the combination of both constant and variable factors that affect the initiation, spread, and ease of controlling a wildfire.
- **Fire Danger Rating Systems (FDRS)** have a primary objective of assessing fuel and weather conditions and provide broad estimates about fuel flammability and the potential fire behaviour under those conditions.





Project aim

to establish and test the scientific underpinning and key components required to build an effective, tailored UK fire danger rating system for use in establishing the likelihood and impact of current and future fire regimes



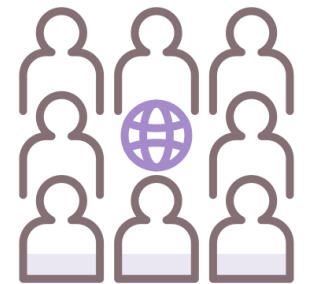
Project by numbers

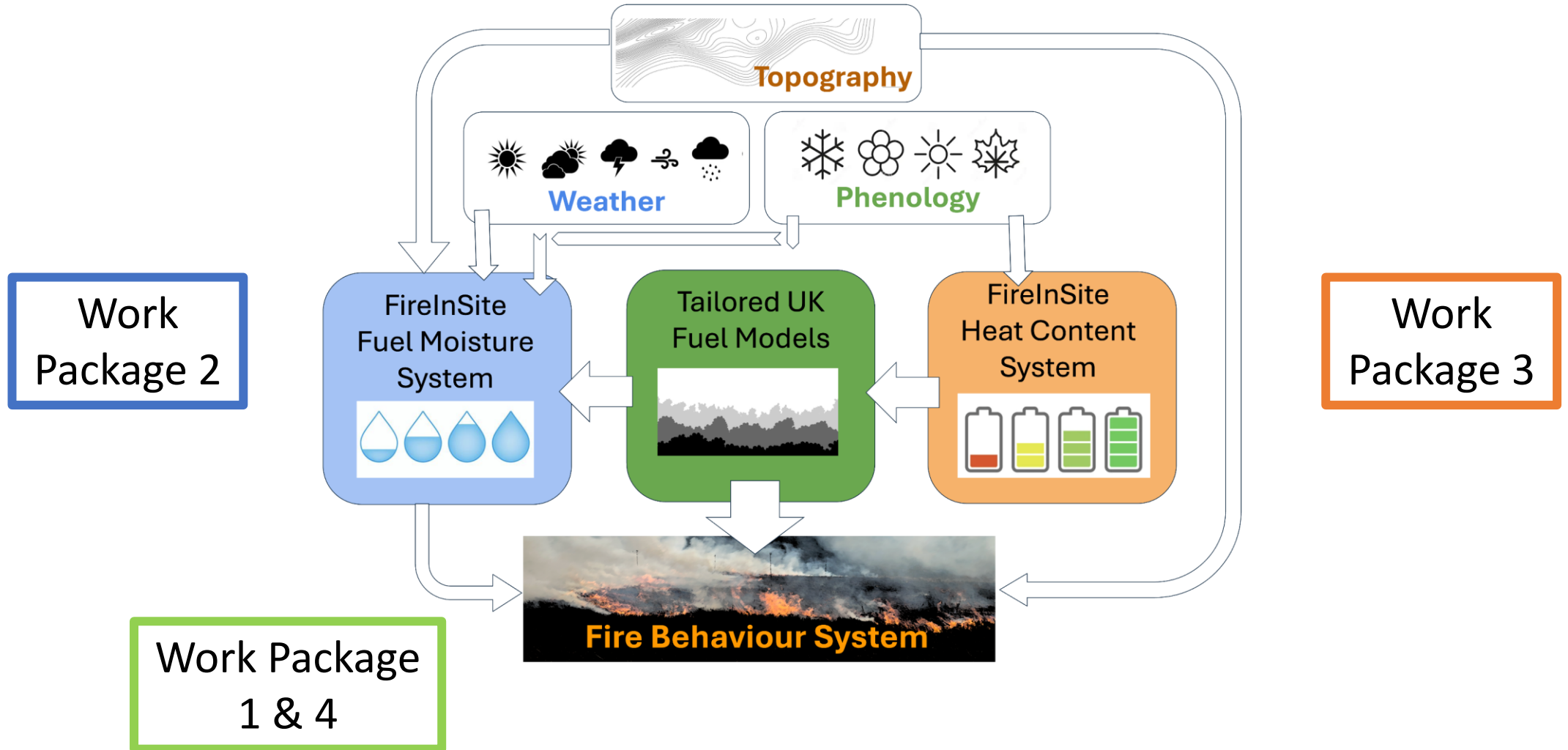
- **29** team members past and present
- Over **50** team meetings and workshops (online and in-person)



- **5** published open access papers (to date)
- Attendance at **12** national and international conferences
- **>1** TB of Earth Observation and geospatial data

- **>50** media interviews
- **134** people involved sending in samples as part of the Great Fuel Moisture Survey







Underpinning data – phenology and fire occurrence

- Monthly VIIRS active fire detection counts for different UK climatic regions and key (CEH) vegetation cover, 2012-2023.
- Out of phase with peak fire weather.

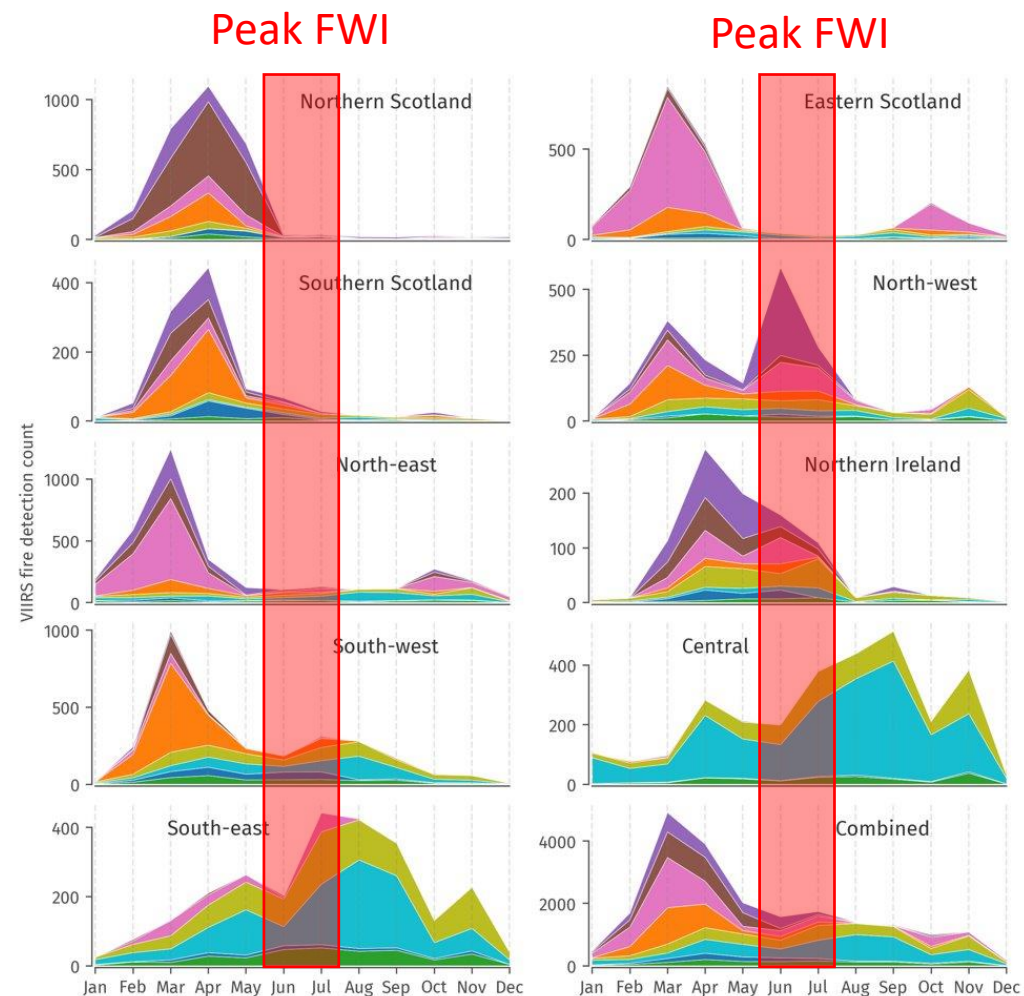
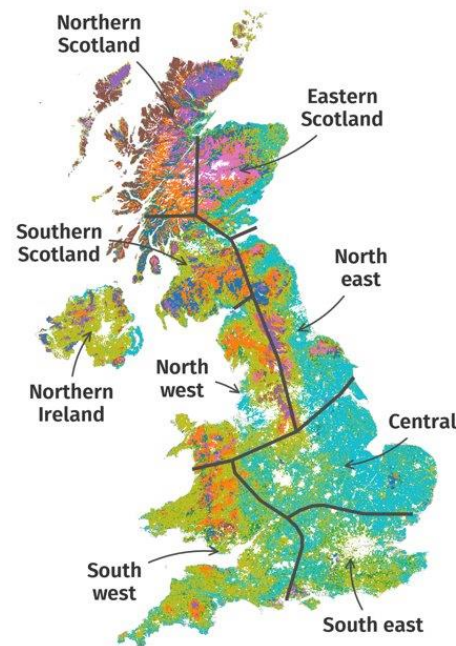


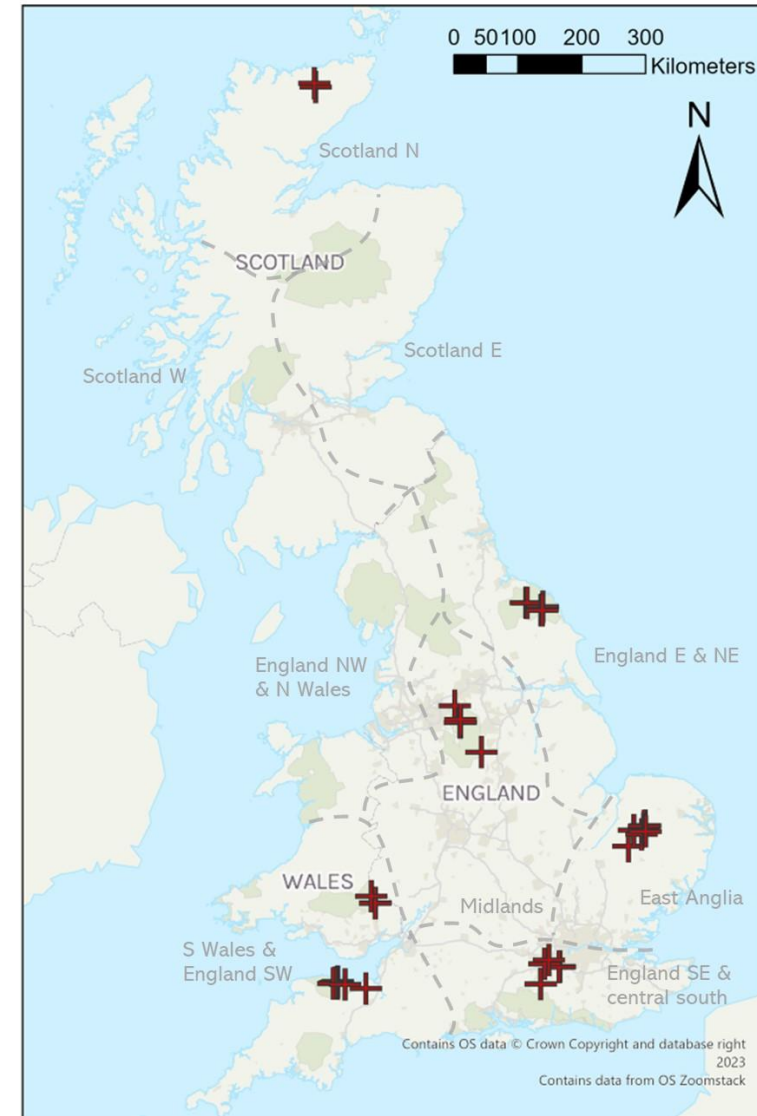
Figure: Nikonovas et al. (2024)
Int. J. Wildland Fire



Underpinning data – fuel moisture

- National-scale temperate fuel moisture dataset:
 - 43 sampling sites covering a range of landscape characteristics
 - Eighteen fuel constituents
 - Samples collected over 130 days (2021 - 2023)
 - **5,845 samples total**

Data is summarised in
Scientific Data:



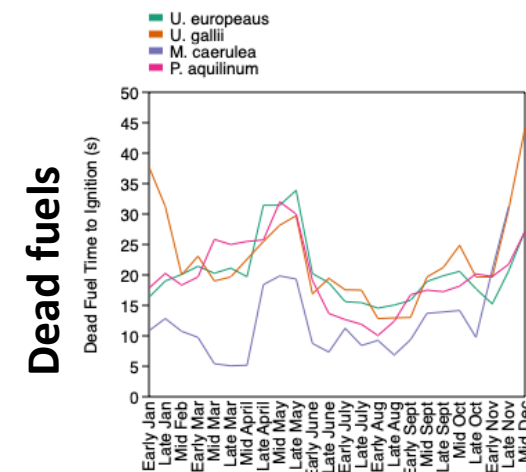


Underpinning data – fuel flammability

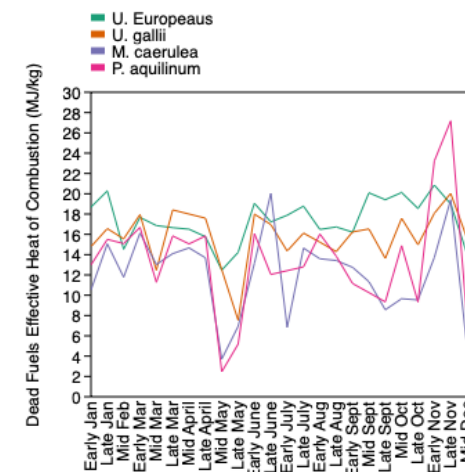
- Variability in Ignitability and Heat Content in **heathland/moorland** fuel types collected over two years for a range of vegetation types
- Ignitability was contrasted with phenology and fuel moisture
- A phenologically varied heat content model was constructed for implementation in each fuel model of **FireInSite**



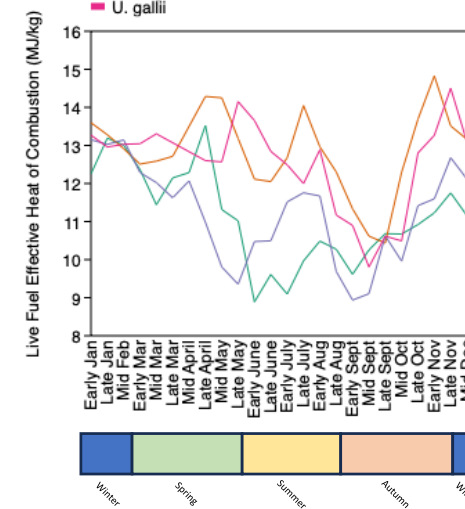
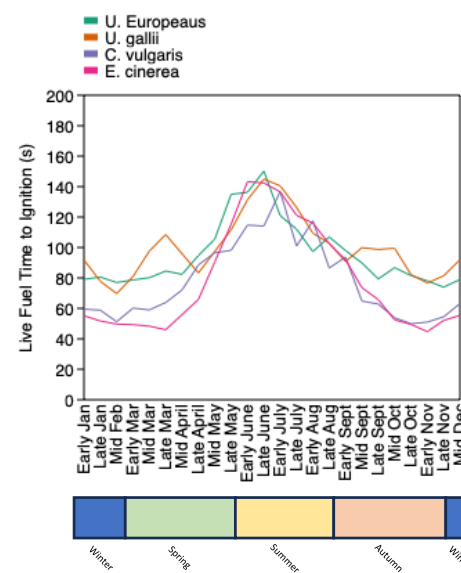
Time taken to ignite



'Heat content'



Live fuels



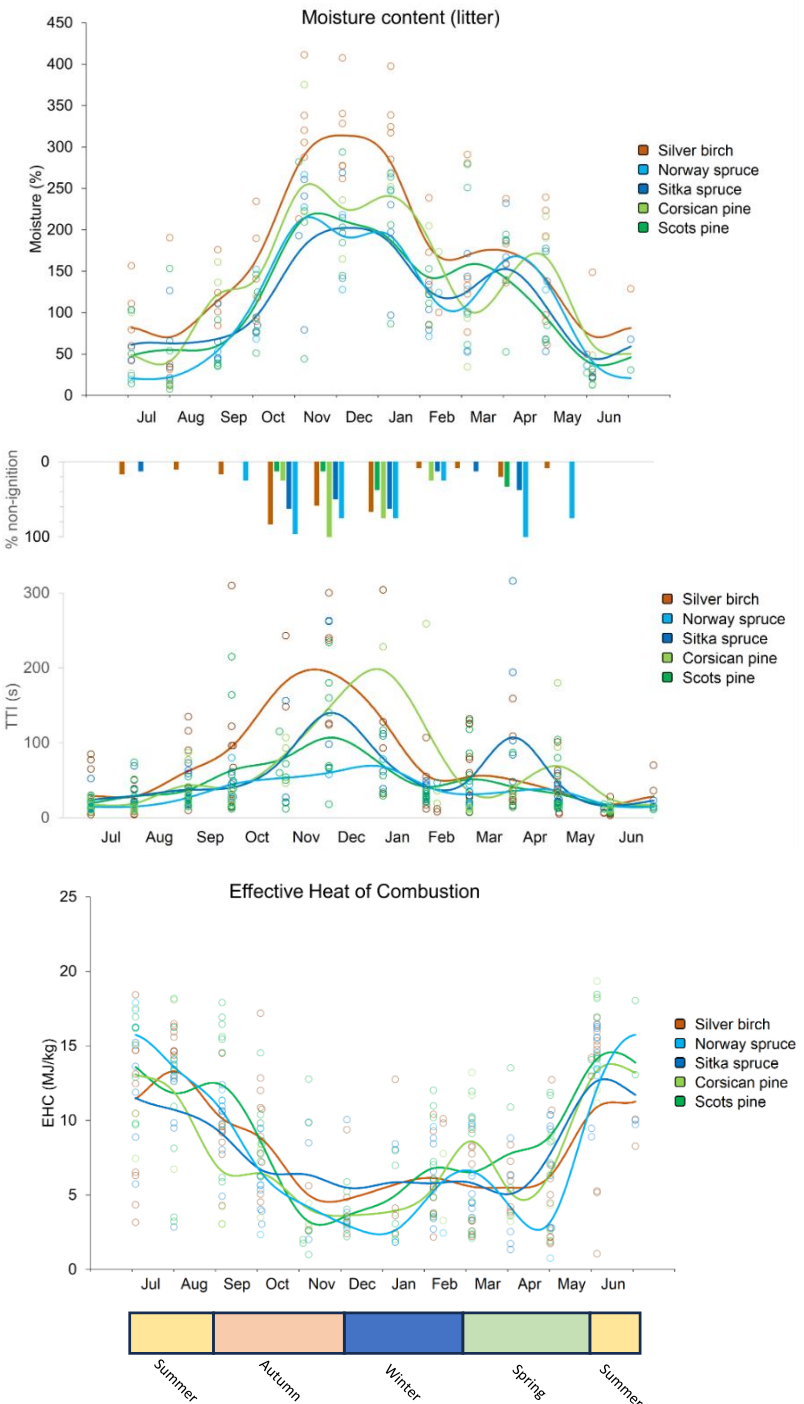
Underpinning data – flammability

- We sampled several key litter fuels over the period of a year two spring-summer and one winter period.
 - 2 spruce species
 - 2 pine species
 - Silver birch
- Studied:
 - Litter moisture content
 - Ignitability (time to ignition)
 - Energy content
- These were used to inform fuel models and the moisture models within **FireInSite**



Forest Research National Forest Inventory Plots

Crawford et al. (in review) *Forestry*



17 Fuel Models that run in FireInSite



Grass fuels:

low, medium and high load grass-dominated fuel models



Calluna-dominated fuels:

low, medium, high load and degenerate phase *Calluna* fuel models



Mixed heath fuels:

Two dwarf shrub-dominated fuel models. One low and the other moderate load of herbaceous vegetation



Gorse fuels:

low (0.6m), medium, high and tall (~2.5m) gorse fuels



Fern vegetation dominated by bracken ferns. Very high herbaceous load. Fuel bed depth over one metre.



Broad leaf litter fuel



Needle litter fuels:

One fuel model for short needle litter and one for long needle litter

We aim to add more fuel models, but at present have focussed on the main fire prone surface fuel types in the UK



UKFDRS elsewhere at the conference

Posters

- Belcher *et al.* – FireInSite (try it for yourself!)
- Ivison *et al.* – fuel moisture during 2022 Heatwave
- Little *et al.* – synoptic climatology of wildfires
- Millin-Chalabi *et al.* – dynamic fuel mapping in the South Pennines
- Pacheco Pascagaza *et al.* – national vegetation maps

Talks

- Next in Room 2: Little *et al.* - landscape controls on fuel moisture



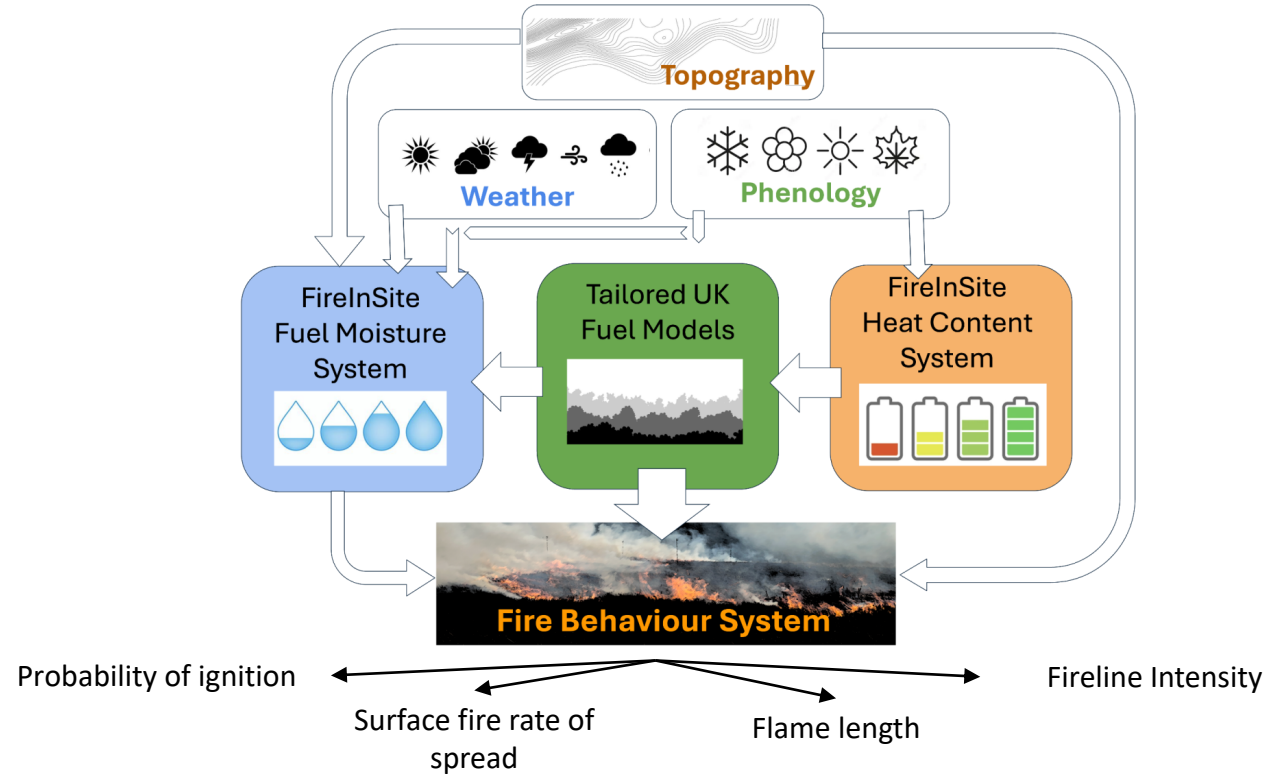
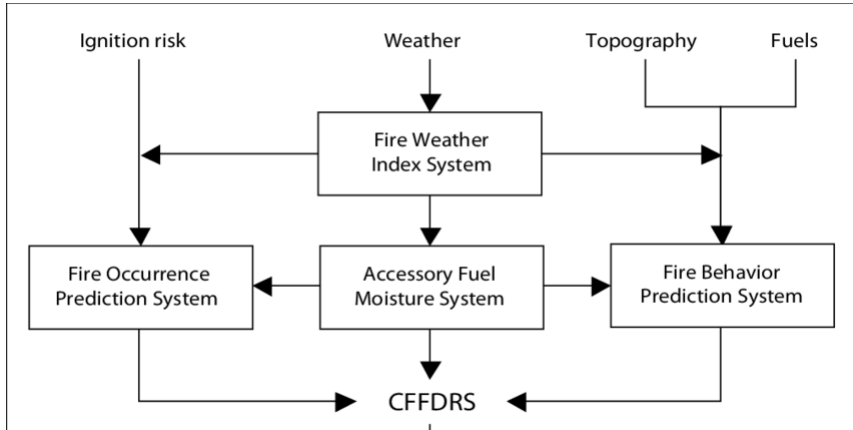
Once you've taken a look at FireInSite please complete our simple survey!



Little et al. (2024) in
Fire Ecology



How does this work relate to existing FDRS thinking?

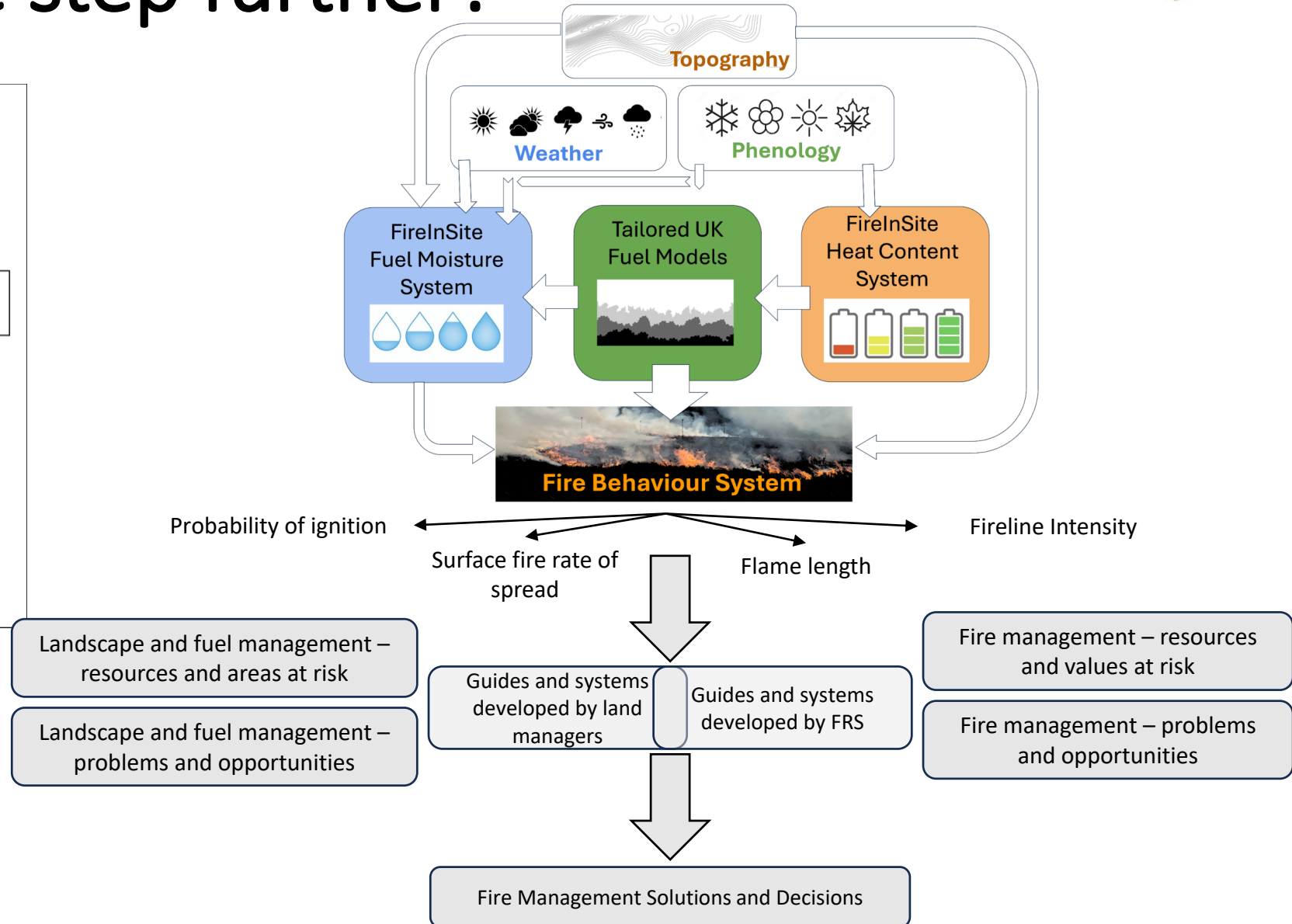
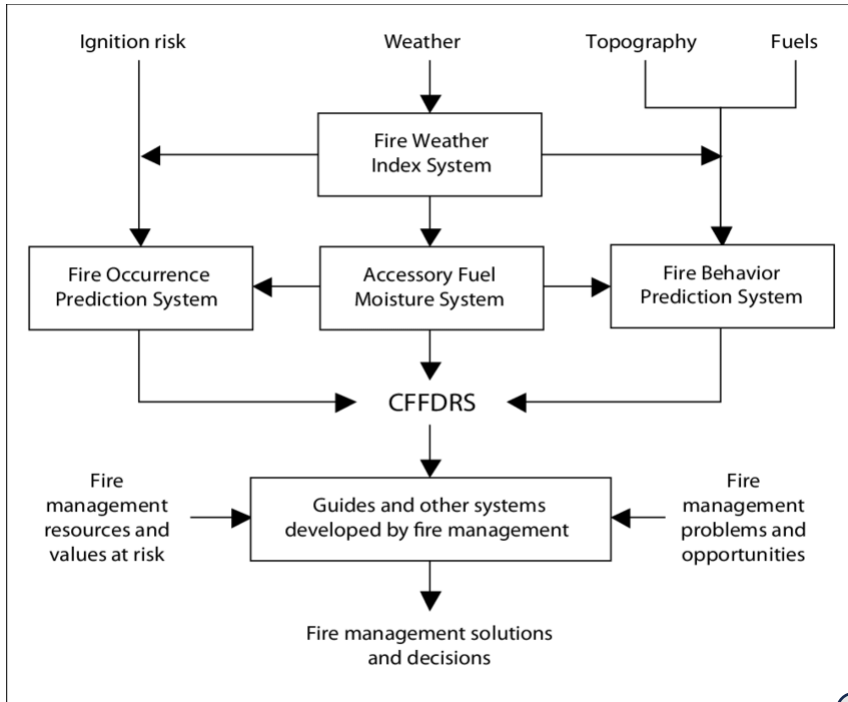


Canadian Forest Fire Danger Rating System





Can we go one step further?





What else do we need to know?

- From a technical perspective, what other elements would be useful to your work or organisation?
- What work needs to take place that FRS and land managers can adopt the system in their day-to-day practice or workflows?
- We've described a system that focuses on practitioners, but what do we need to do to turn this into a public-facing system?
- What work is needed in wildfire risk communication so that the public is ready to receive fire danger messages?



Long-term development

- The UKFDRS project currently finishes at the end of 2024
 - Specific outputs will come out throughout 2024 and 2025
 - Synthesis paper/report summarising the key findings and outcomes to be drafted in 2025
- Future opportunities
 - Integrate into existing processes by practitioners, emergency responders and local & central government
 - Develop operational tools for a range of audiences
 - Follow on research activities and projects

...if you have any ideas, do get in touch!

Any questions?

For more on the project, visit www.ukfdrs.com or follow us on Twitter @ukfdrs

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