The University of Manchester

Improving management of UK wildfire through knowledge exchange

NATURAL ENVIRONMENT RESEARCH COUNCIL

The UK wildfire research landscape

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Institution of Fire Engineers RE13, Fire Services College, Moreton-in-Marsh, 14 Nov 2013 1

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Structure of session

1. Context: Knowledge for Wildfire project
2. Researcher survey: aim, methods, results, what next

Moorland: Harbottle, Northumberland April 2007

Rural-urban interface: Upton Heath, Dorset, June 2011

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KNOWLEDGE FOR WILDFIRE PROJECT

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CONTEXT

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KfWf
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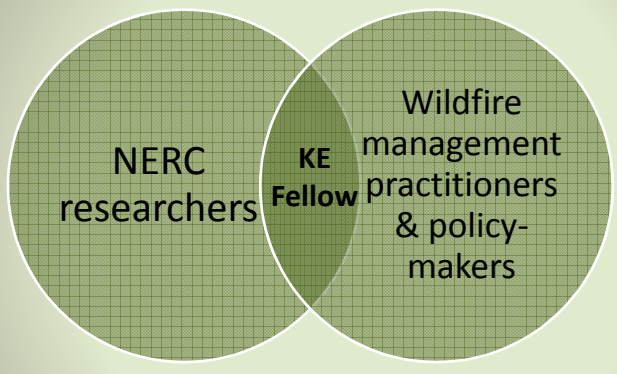
KE Fellow's role



- Funded for 2 years at 2 days a week, Oct 2012 - Sep 2014
- Top up funding from NERC; from 1st Oct 2013 →1.5 days a week, extended to 3rd year

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KfWf project aims

- To maximise the use of existing NERC-funded research and promote mutually beneficial new research and KE projects on wildfire;

  improve the evidence base for managing wildfire risk in the UK
- To assist the management of wildfire risk in the UK at all stages from prevention to response and recovery

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Who we are

http://kfwf.org.uk/about/staff/

Julia McMorrow
KE Fellow,
KfWf project leader

Ioanna (Jo) Tantanasi
Administrative assistant

Gareth Clay
Communications officer

Steering Group http://kfwf.org.uk/about/steeringgroup/

Paul Hedley	CFOA Wildfire Group
Steve Barnes	Civil Contingencies Secretariat, Cabinet Office
Phil Philippou	Resilience and Emergencies Division, DCLG
Jonathan Aylen	Manchester Business School
Simon Thorp	The Heather Trust

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KfWf project objectives

Who does what research?

1. **Connect** emerging cross-sector and cross-disciplinary interests in wildfire; awareness-raising and advocacy role
2. **Apply** NERC's existing fire-related research, and use research to **adapt** (add value to) user data
3. **Create**/facilitate new partnership research and KE which addresses knowledge gaps

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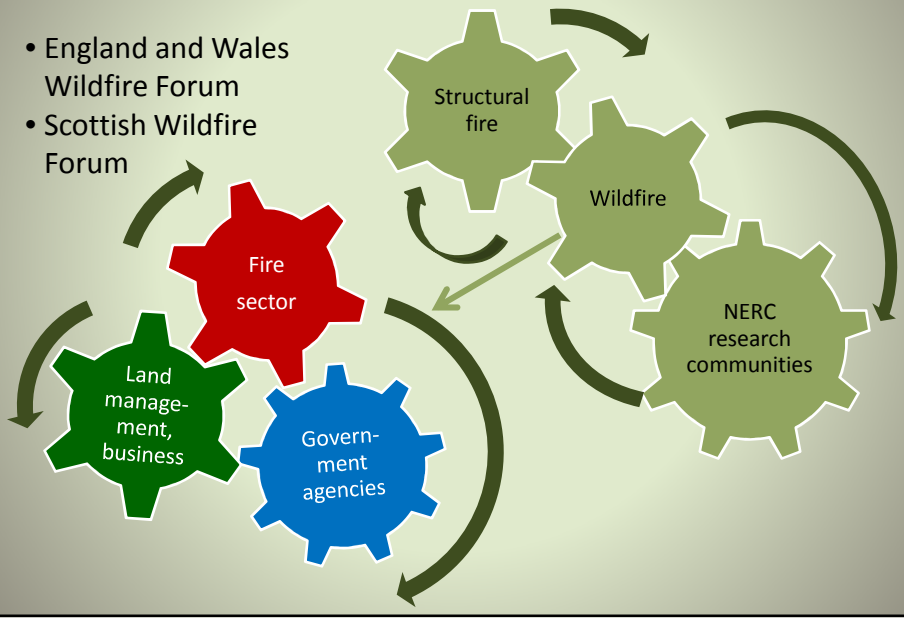
Connect

- England and Wales Wildfire Forum
- Scottish Wildfire Forum



KfWf approach & Activities

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'Know-what'
'Know-why'

'Know-how'

Apply	• Existing research	Grow network
	Reports, Papers, Researcher survey	
Adapt	• End users' data	Connect
	GMFRS IRS mapping project	
Create	• New partnership research	Maintain
	NERC PURE KTA project with Forestry Commission	

'Know-who'

Networking:
- wildfire@ manchester events
- Conference sessions
- Attending workshops & Forums
- Website www.Kfwf.org.uk
- Twitter KfWf_Manchester

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RESEARCHER SURVEY

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Motive and Aim

Practitioners and policy-makers require evidence-based decisions, but don't know who to go to.

Aim: to ascertain the UK's current research capability on vegetation fire, including strengths and knowledge gaps

- 'Who Does What' survey of UK researchers working on vegetation fire, starting with environmental and physical science academics
- For KfWf website; dynamic, open -- invite others in the wildfire community to contribute

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Method

1. Knowledge gaps from FIRES seminar series policy brief (2010). Delphi process
2. Living With Environmental Change (LWEC)'s Envirobase → £4 M fire-related research projects
3. Email survey of 22 key contacts. Replies or on behalf of 20 the 22 researchers contacted, from 11 of the 15 universities.

   Researchers were asked:

   - To provide a brief outline of their research;
   - To suggest ways in which the two wildfire stakeholder forums (England and Wales Wildfire Forum (EWWF), and Scottish Wildfire Forum) might interact with or support their work

   Analysed responses → keywords → Draft research capability matrix
4. Extending survey through KfWf. Asking researchers for a 'taster' slide, which will be linked to the matrix.

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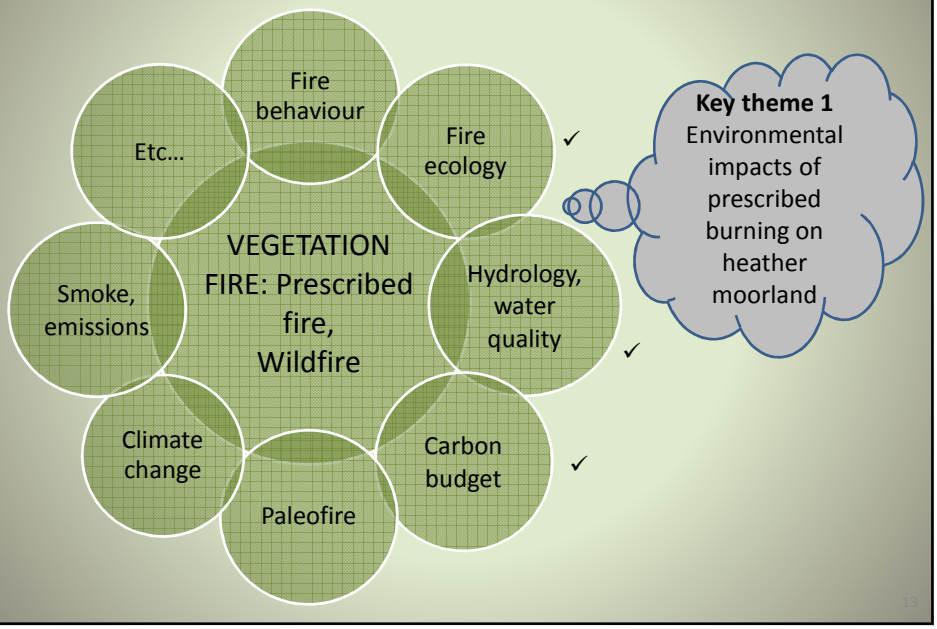
What NERC/EPSRC fire researchers study



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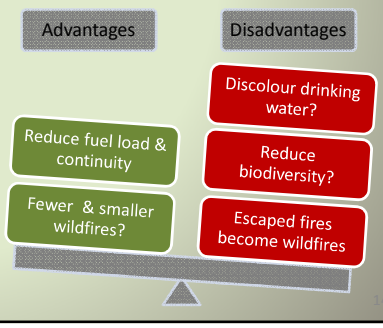
Key theme 1: Environmental impact of prescribed burning

Rotational burning of heather for grouse moor management & grass moors for pasture

- Reflects long-standing controversy about impact on biodiversity, soil, carbon budget, water quality
- And whether it reduces or increases wildfire. Policy disconnect
- Heightened by current **carbon agenda** and **ecosystem services** of UK peatlands
- Conflicting findings from NERC projects



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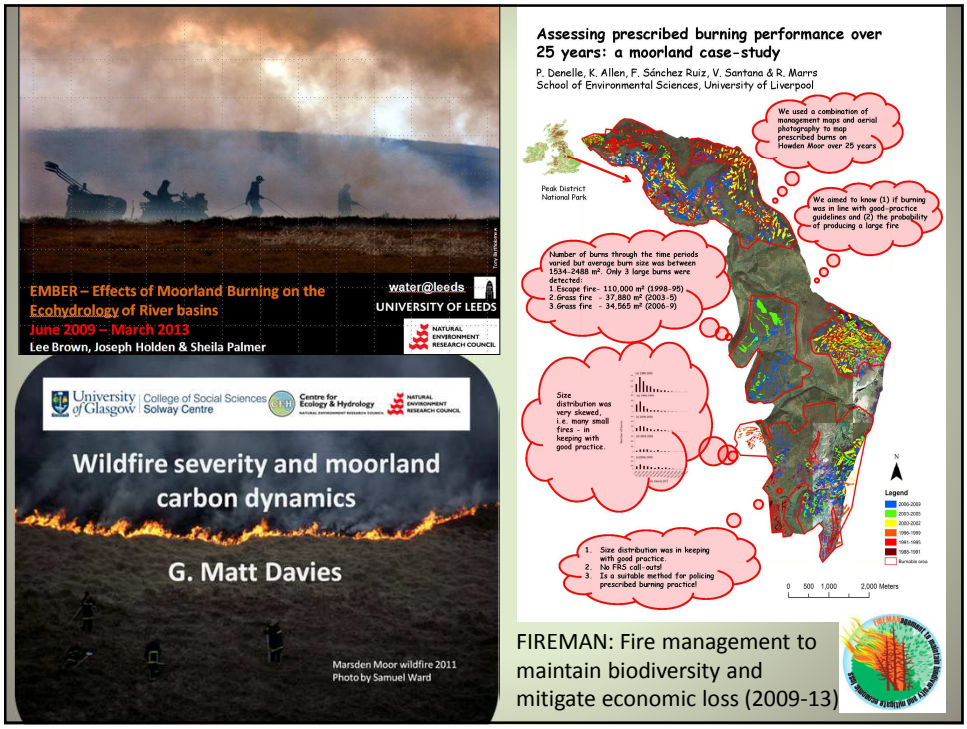
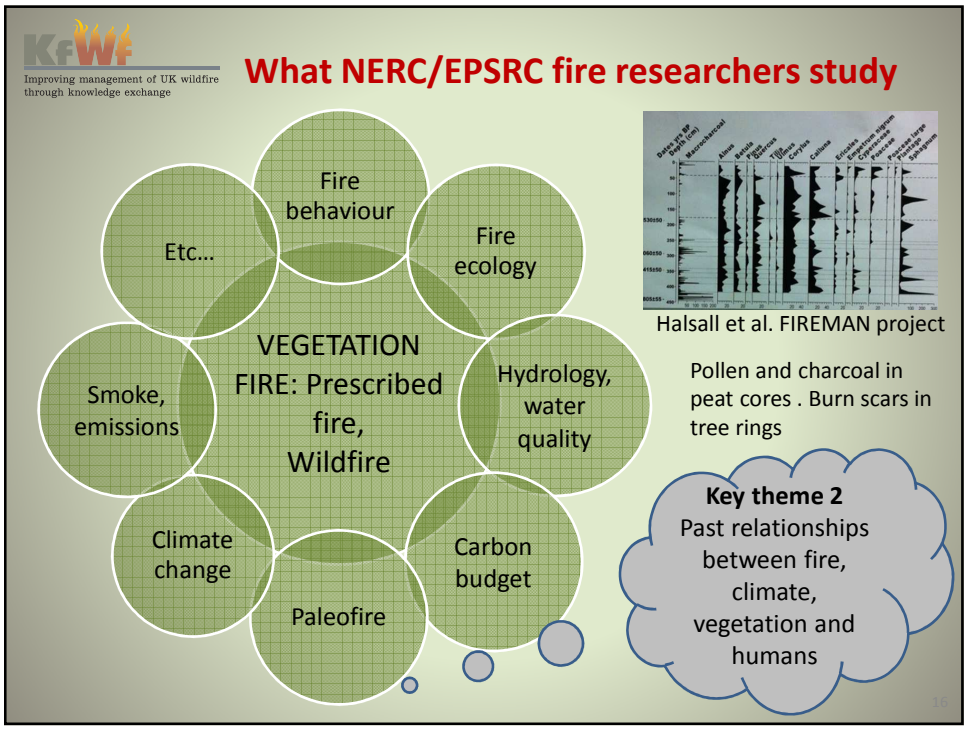


FIREMAN: Fire management to maintain biodiversity and mitigate economic loss (2009-13)



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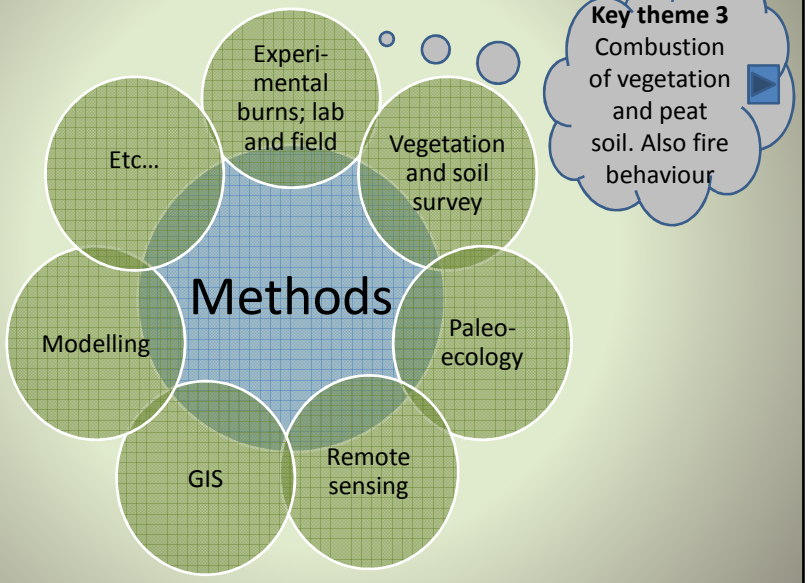
How vegetation fire is studied



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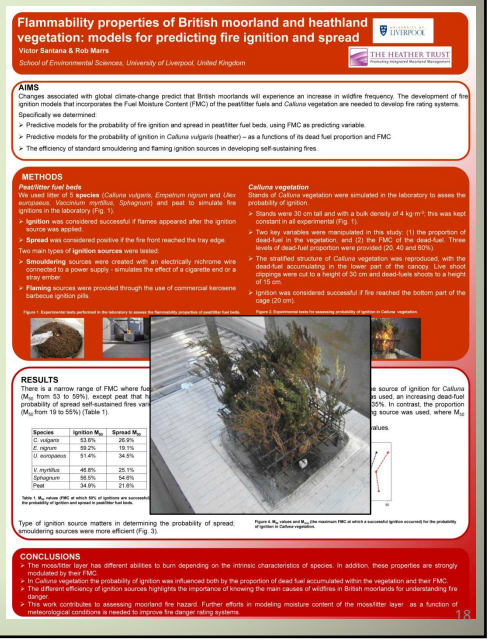
Key theme 2: Combustion and fire behaviour

- Combustion of vegetation and peat soils (lab and field burns)
- **Knowledge gap**: behaviour of high intensity summer fires in UK conditions; most fieldwork uses prescribed fires in winter legal burn season, or fire behaviour models not adapted to UK conditions



Flammability properties of British moorland and heathland vegetation: models for predicting fire ignition and spread

Victor Santana & Rob Marrs

School of Environmental Sciences, University of Liverpool, United Kingdom

THE HEATHER TRUST

AIMS

Changes associated with global climate-change predict that British moorlands will experience an increase in wildfire frequency. The development of fire ignition models that incorporates the Fuel Moisture Content (FMC) of the peat/litter fuels and *Calluna* vegetation are needed to develop fire rating systems.

Specifically we determined:

- Predictive models for the probability of fire ignition and spread in peat/litter fuel beds, using FMC as predicting variable.
- Predictive models for the probability of ignition in *Calluna vulgaris* (heather) – as a functions of its dead fuel proportion and FMC
- The efficiency of standard smouldering and flaming ignition sources in developing self-sustaining fires.

METHODS

Peat/litter fuel beds

We used litter of 5 **species** (*Calluna vulgaris, Empetrum nigrum* and *Ulex europaeus, Vaccinium myrtillus, Sphagnum*) and peat to simulate fire ignitions in the laboratory (Fig. 1).

- **Ignition** was considered successful if flames appeared after the ignition source was applied.
- **Spread** was considered positive if the fire front reached the tray edge.

Two main types of **ignition sources** were tested:

- **Smouldering** sources were created with an electrically nichrome wire connected to a power supply - simulates the effect of a cigarette end or a stray ember.
- **Flaming** sources were provided through the use of commercial kerosene barbecue ignition pills.

Calluna vegetation

Stands of *Calluna* vegetation were simulated in the laboratory to asses the probability of ignition.

- Stands were 30 cm tall and with a bulk density of 4 kg·m^{-3}; this was kept constant in all experimental (Fig. 1).
- Two key variables were manipulated in this study: (1) the proportion of dead-fuel in the vegetation, and (2) the FMC of the dead-fuel. Three levels of dead-fuel proportion were provided (20, 40 and 60%).
- The stratified structure of *Calluna* vegetation was reproduced, with the dead-fuels accumulating in the lower part of the canopy. Live shoot clippings were cut to a height of 30 cm and dead-fuels shoots to a height of 15 cm.
- Ignition was considered successful if fire reached the bottom part of the cage (20 cm).

Figure 1. Experimental tests performed in the laboratory to assess the flammability properties of peat/litter fuel beds.

Figure 2. Experimental tests for assessing probability of ignition in *Calluna* vegetation.

RESULTS

There is a narrow range of FMC where fuel (M_{50} from 53 to 59%), except peat that h... probability of spread self-sustained fires var... (M_{50} from 19 to 55%) (Table 1).

Species	Ignition M_{50}	Spread M_{50}
C. vulgaris	53.6%	26.9%
E. nigrum	58.2%	19.1%
U. europaeus	51.4%	34.5%
V. myrtillus	46.8%	25.1%
Sphagnum	56.5%	54.6%
Peat	34.9%	21.6%

Table 1. M_{50} values (FMC at which 50% of ignitions are successful) for the probability of ignition and spread in peat/litter fuel beds.

Type of ignition source matters in determining the probability of spread; smouldering sources were more efficient (Fig. 3).

Figure 4. M_{50} values and M_{max} (the maximum FMC at which a successful ignition occurred) for the probability of ignition in *Calluna* vegetation.

CONCLUSIONS

- The moss/litter layer has different abilities to burn depending on the intrinsic characteristics of species. In addition, these properties are strongly modulated by their FMC.
- In *Calluna* vegetation the probability of ignition was influenced both by the proportion of dead fuel accumulated within the vegetation and their FMC.
- The different efficiency of ignition sources highlights the importance of knowing the main causes of wildfires in British moorlands for understanding fire danger.
- This work contributes to assessing moorland fire hazard. Further efforts in modeling moisture content of the moss/litter layer as a function of meteorological conditions is needed to improve fire danger rating systems.

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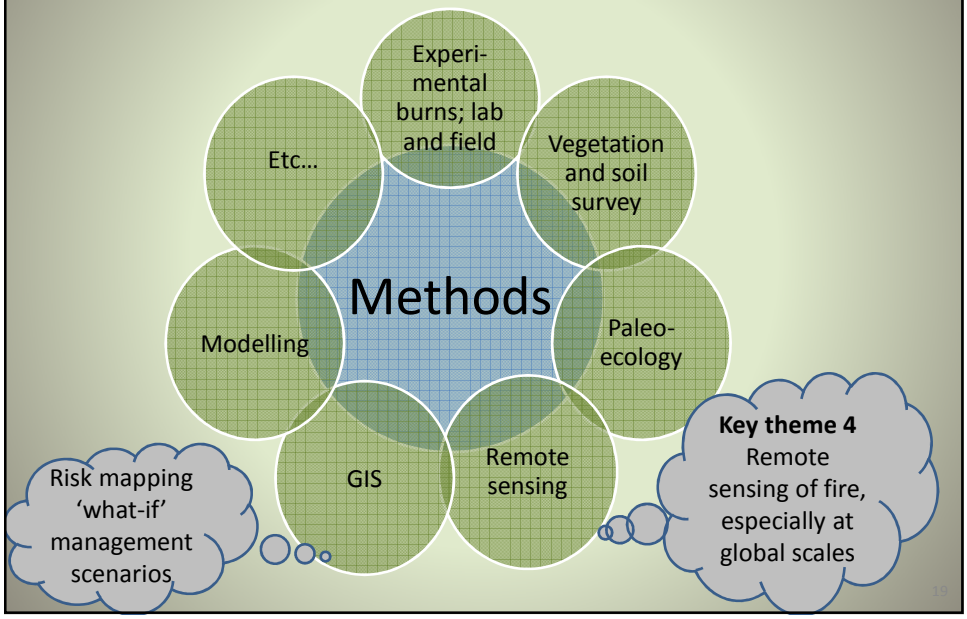
How vegetation fire is studied



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Research capability matrix

	Fire behaviour	Hydrology	Carbon	Remote sensing	Etc …
Manchester	▶		●	●	
Liverpool		▶	●		●
Etc…		●			●

Inviting researchers to submit a 'taster slide, which can be linked to the matrix. Biographical style, or:

- Photo of data being collected or a graph,
- A significant finding and why it's relevant
- Contact for further information

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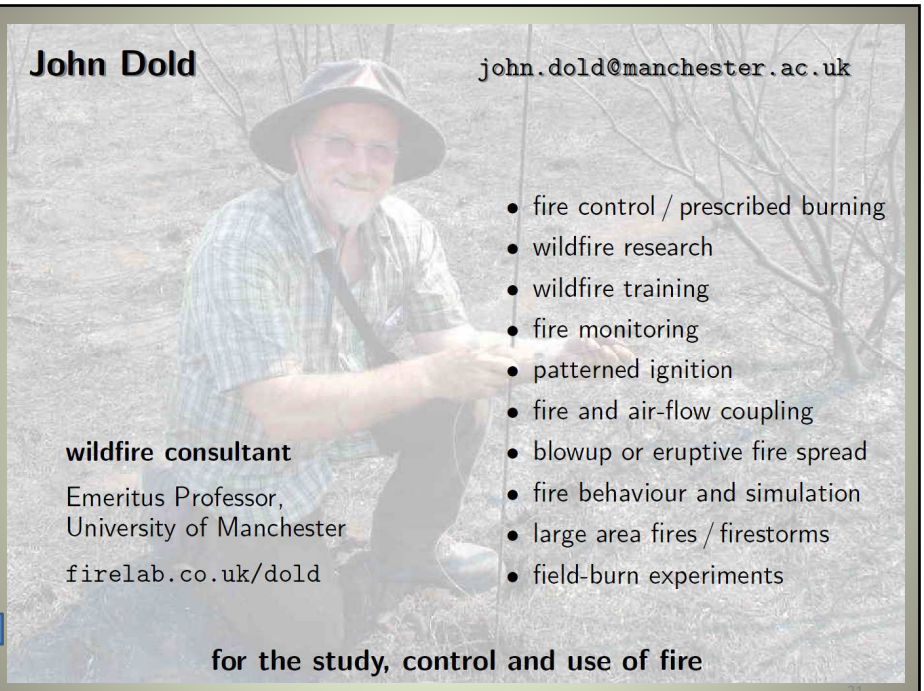


Fire effects on runoff, erosion and water quality

Dr Hugh Smith

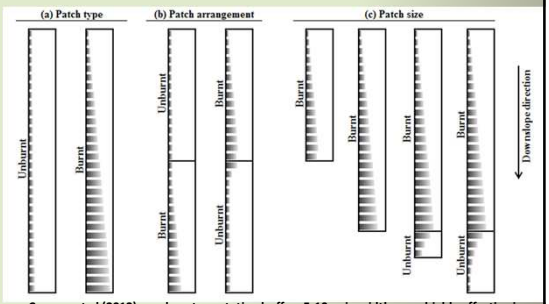
School of Environmental Sciences, University of Liverpool, hugh.smith@liverpool.ac.uk

Background: researching wildfire and prescribed fire in Australia since 2003: published 18 papers and 4 reports for management agencies to date.

Aim to apply fire research experience and methods in the UK.

Key questions:

1. How does burn patchiness affect runoff and sediment connectivity from patch to hillslope scales?
2. Can we design prescribed burns to minimise possible impacts on soil and water resources?
3. Does wildfire present a future threat to water supply catchments in the UK under a changing climate?



Cawson et al (2013) - unburnt vegetation buffers 5-10 m in width were highly effective in reducing runoff and erosion after prescribed burning

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Example paper: Cawson JG, Sheridan GJ, Smith HG, Lane PNJ (2013) Effects of fire severity and burn patchiness on hillslope-scale surface runoff, erosion and hydrologic connectivity in a prescribed burn. *Forest Ecology and Management*, 310: 219-233.

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Where next

- Continue to contact researchers identified from LWEC survey and networking
- Invite feedback on the draft matrix, including keywords used
- Publish on KfWf website. Disseminate to practitioners and policy-makers via Fire Forums, etc.
- Dynamic, will evolve as others add data

Ideally:

- Invite a wider range of other institutions and scientists to contribute, including social scientists
- Extend to UK-based researchers working internationally,
- Deeper analysis, e.g. social network analysis (who works with who)

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Thank you for listening

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