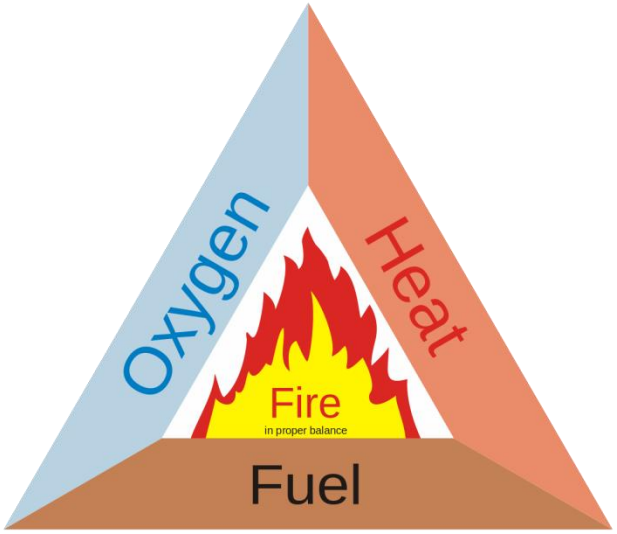
# WILDFIRES AND LAND MANAGEMENT

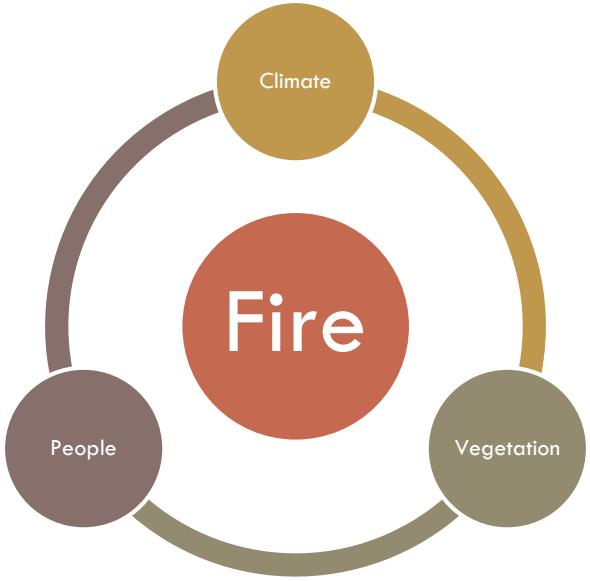
Dr Gareth Clay, University of Manchester

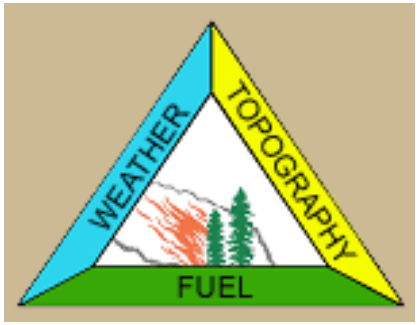
BogFest17, 23 Sep 2017

# Fire is an interdisciplinary issue

- Fire as part of the Earth system
  - Coupled with climate and biogeochemistry




*Fire behaviour triangle*

- Fire is also a socio-ecological system
  - Hard to uncouple people from fire

# What are wildfires?

- a.k.a wildland fires, bushfires, scrubland fires

- Any unplanned and/or uncontrolled vegetation fire which may require suppression, regardless of cause

Moorland fire in Northumberland National Park

Canyon fire in Mediterranean vegetation

# What are wildfires?

- *"Any uncontrolled vegetation fire which requires a decision, or action, regarding suppression"* (Scottish Government, 2013)

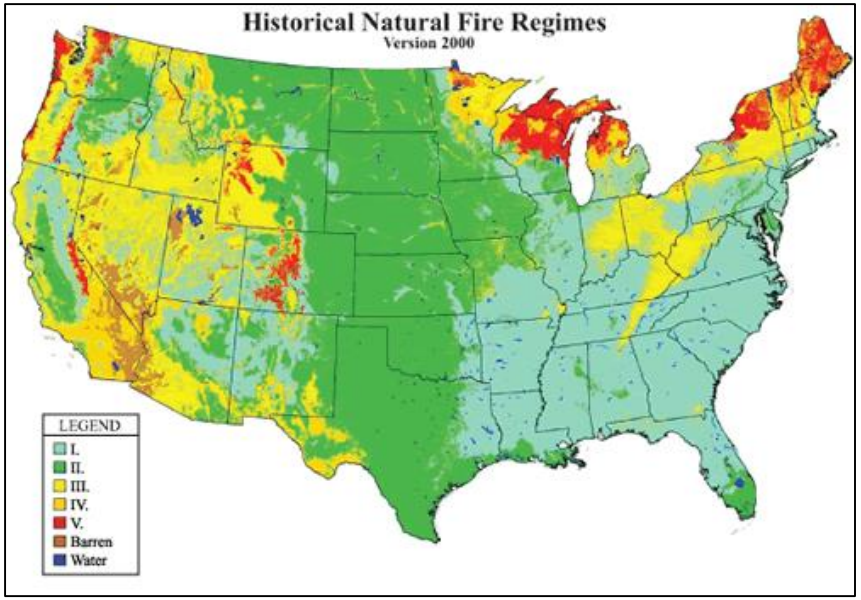
- Wild used to refer to wildland location e.g. Great plains, Canada,

- Now tends to refer to out of control behaviour – negative view, threat

# Fire regime

- Characteristics of an area's fire history

- WHAT
  - **Causes** – human/natural
  - **Type** – surface, crown, soil
  - **Size** – burnt area
- WHERE
  - **Fuel** type
  - Spatial **location**
- WHEN
  - **Fire season** - which month
  - **Frequency** of occurrence (number / year)
  - **Return** period (e.g. 1 in 50 year event)




Source: USDA Fire Science Laboratory, Rocky Mountain Research Station

# What controls fire regime?

- Climate
  - Principal control
    - Direct control on fire weather
    - Indirectly via fuel (i.e. vegetation)
  - Temporal variation to consider
    - Daily, seasonal, decadal
- Humans
  - Direct via ignition sources
  - Indirect via fuel (management, fire suppression)
    - Management fires for ecological or other reasons
    - Over-suppression, can allow fuel to accumulate → mega-fires

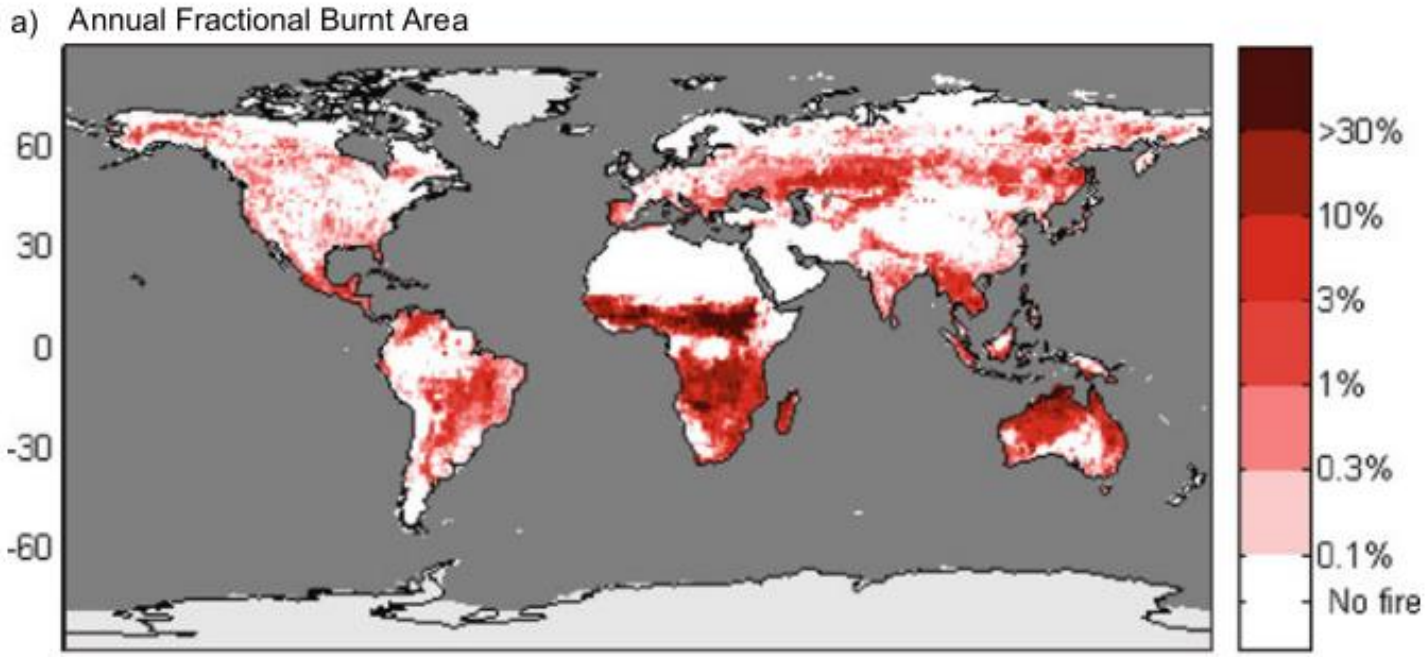
# Fire regime

- Fire size is inversely related to fire frequency
  - Smaller, less damaging fire more common
- Use as a management strategy?
  - Over suppression → larger fires more likely = *fire paradox*
- Fire regimes are dynamic and change with climate and land management:
  - "Fire's removal in places that have long known it may be as ecologically damaging as its introduction to places to which it is alien"

    Pyne (2012)

# Global distribution of wildfires

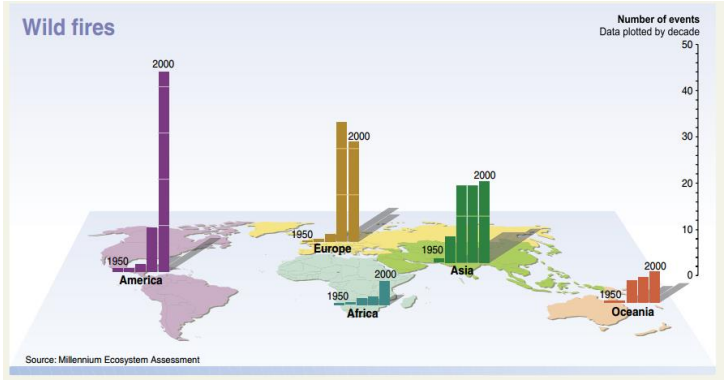
- Most fires in seasonally wet-dry climates: seasonally dry tropical forests, savannas, dry woodlands
- Followed by grassland and scrubland, then temperate and boreal forests



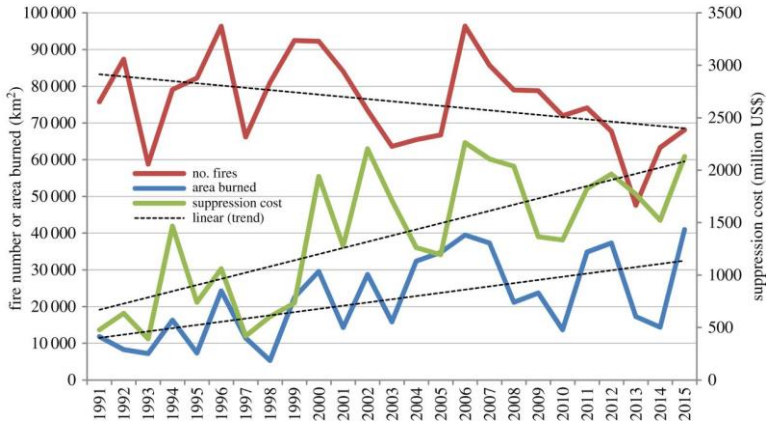

Harrison et al. (2010)

# Recent trends: Global

- Are there any clear global trends?
  - It depends on scale and timeframe
- Up to 2000, increases seen around the world (MEA, 2005)
  - Recent syntheses suggest this may not be so simple
- Data from USA suggest number of fires has decreased, but area burned (and cost associated with suppression) have increased



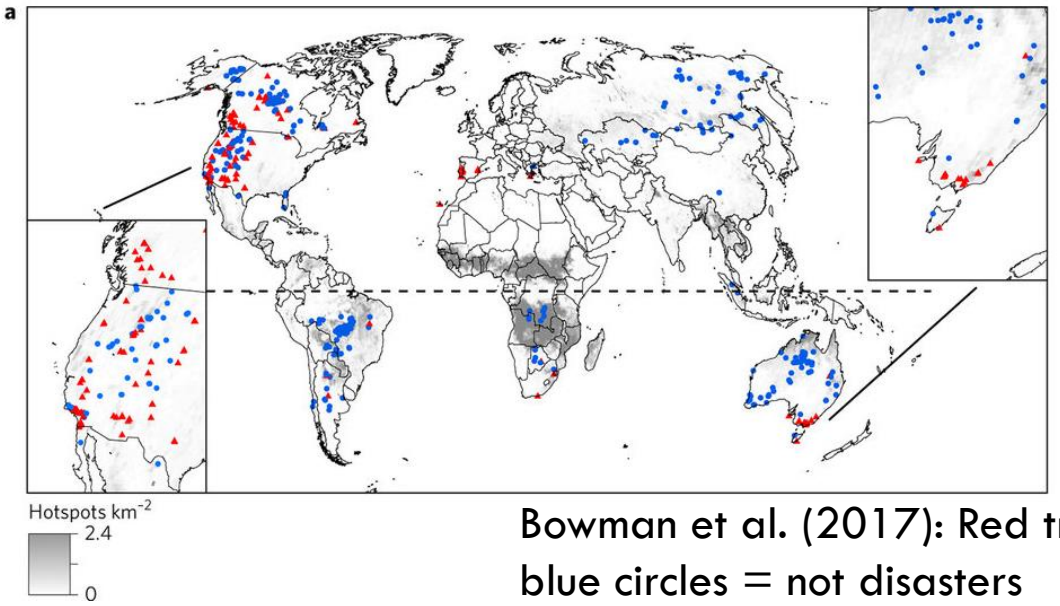

Millennium Ecosystem Assessment (2005)




Doerr and Santin (2016)

# Global mega-fires

- Recent analysis of 478 extreme wildfires, 2002 - 2013
  - 114 economically or socially disastrous
  - Suburban (wildland-urban interface) in western USA and SE Australia




Bowman et al. (2017): Red triangles = disaster, blue circles = not disasters

# UK Fire regime

- Seasonal cycles
  - Two seasons
    - April/May
    - July/August
  - Combination of climate, vegetation and human activity
    - Bank Holidays
    - School Holidays
    - Day of the week
- Spatial patterns
  - Towns
  - Footpaths, car parks

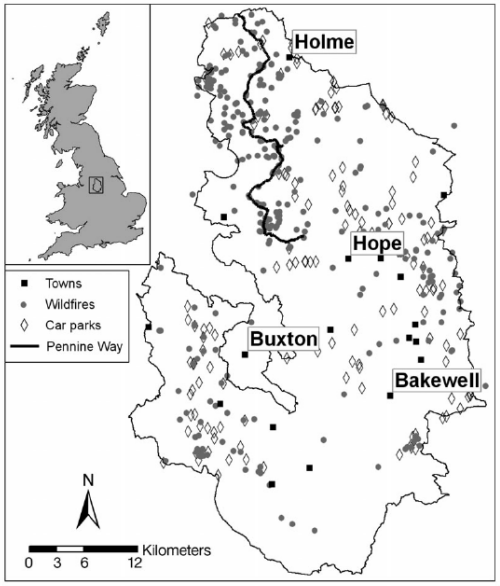



Fig. 1. Peak District wildfires, 1976–2006

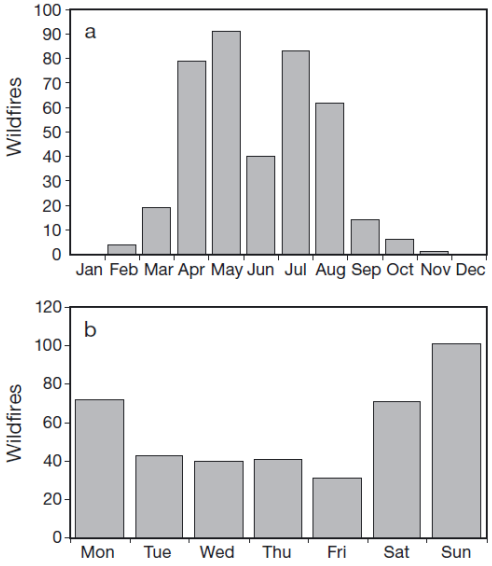
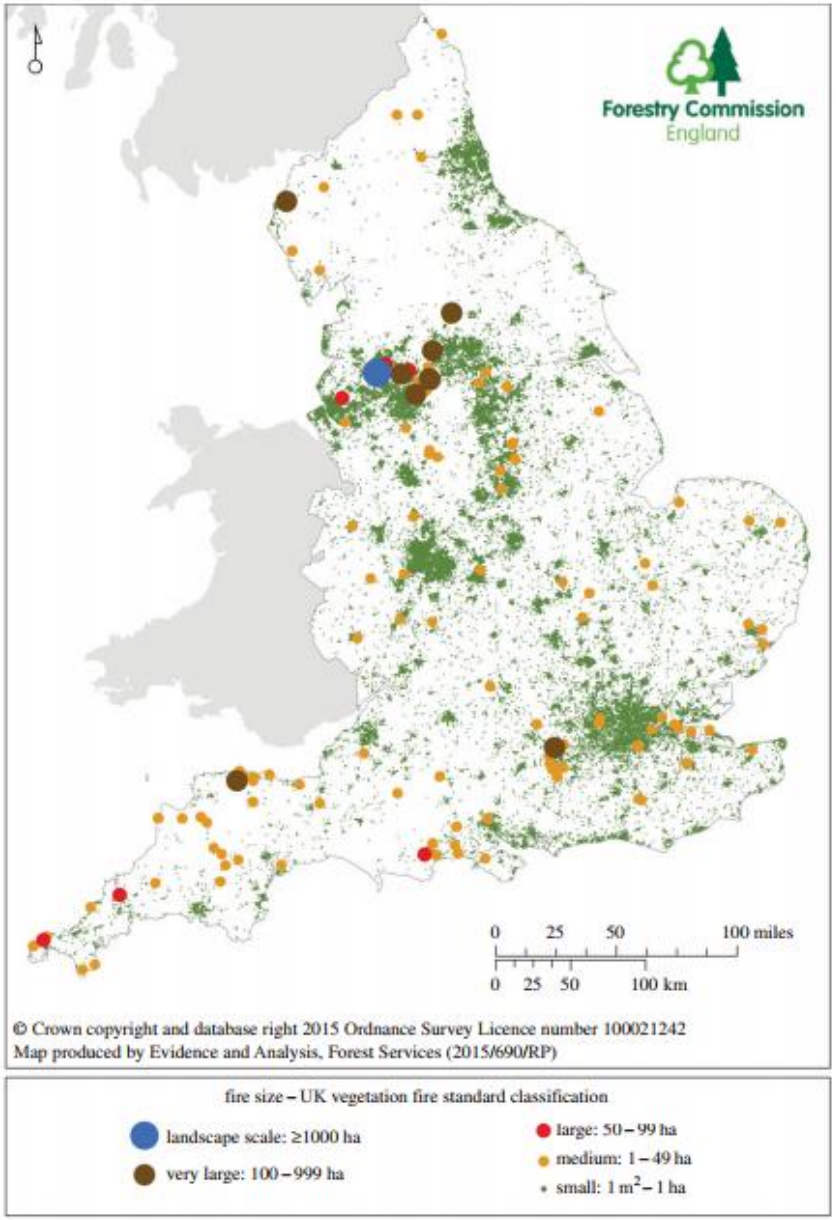



Fig. 2. Total number of wildfires in the Peak District National Park recorded by (a) month (June 1976 to December 2008) and (b) day of week (June 1976 to December 2008)

Albertson et al. (2010)

# UK Fire regime

- Between 2009/10 and 2012/13
  - 210,000 vegetation fire incidents recorded by FRS
- Rural-urban interface
- Nearly 50% are <5m$^2$
- Large fires are few, but cover large areas
  - Resources
  - Environmental and social impact

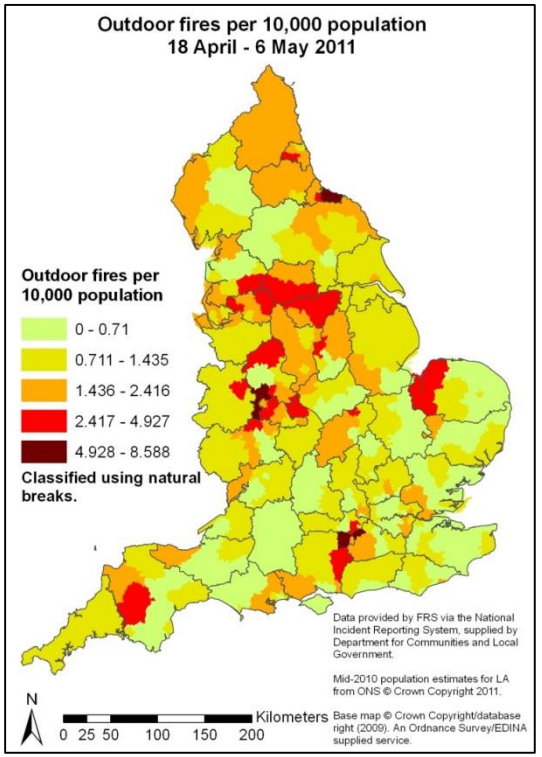



English vegetation fires for one year, FY 2011/12. From Gazzard et al. (2016)

# Case Study: Spring Fires 2011

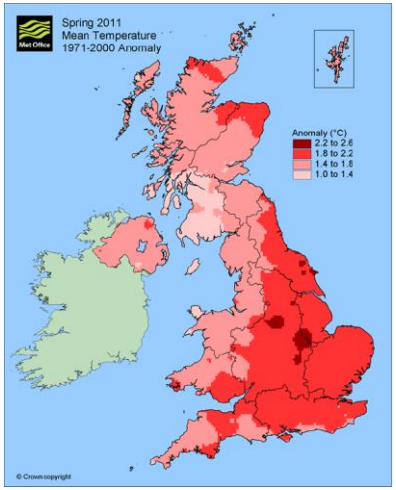

Source: BBC

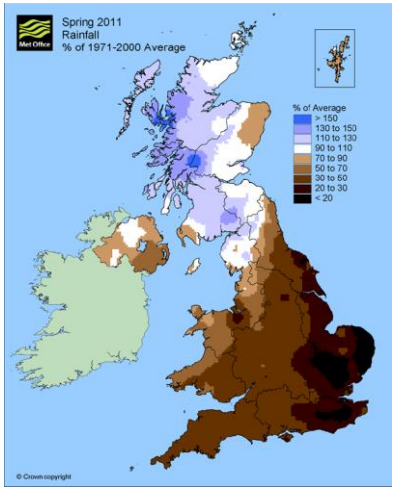
Source: MODIS

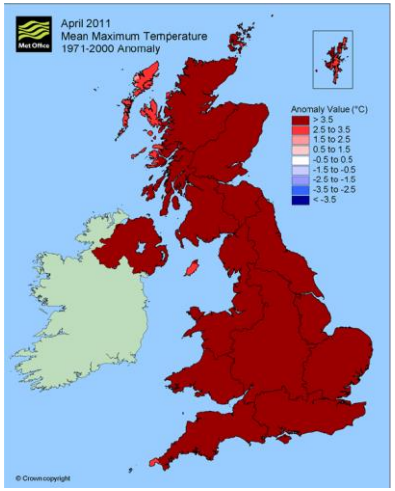


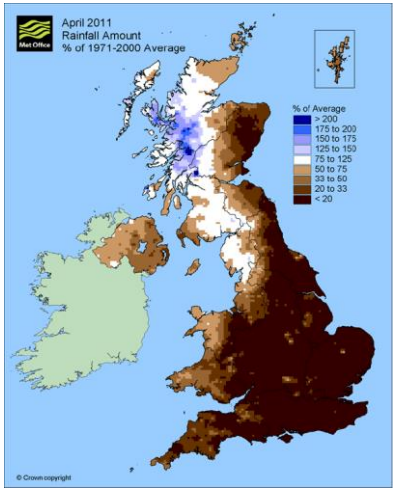

Courtesy of Julia McMorrow

# Exceptional conditions



# Spring 2011 – Swinley Forest

- Mon 2nd May
- High temp, wind, low humidity
- Fire escalated quickly
  - Multiple fire fronts
  - Moved quickly – 7 ha in 20 minutes
  - Jumped fire breaks
- 12 day incident led by RBFRS and Forestry Commission
  - 300 + fire fighters from multiple FRS
- One of largest fire incidents since WWII

Courtesy of Rob Gazzard (Forestry Commission)

# Impact

## Fire Affected Areas

Transport Research Laboratory

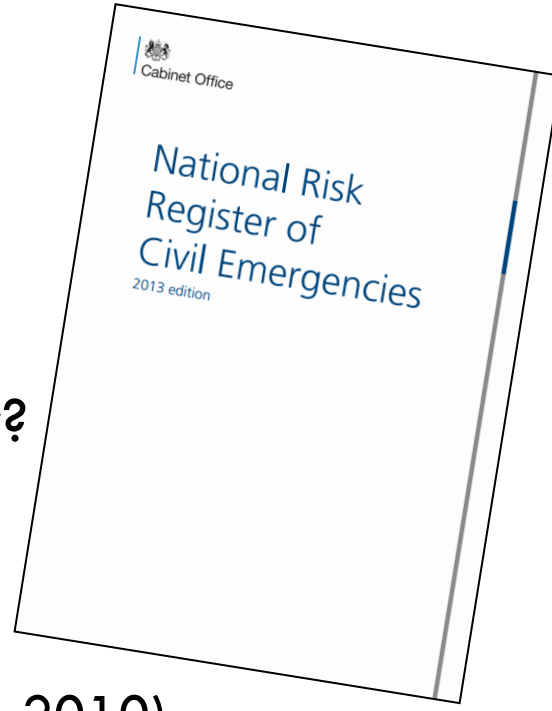

Crowthorne village

Broadmoor High Security Hospital

Bracknell Forest Council

# Risk register

- Preparation for civil emergencies
  - Damage to human welfare
  - Damage to environment
  - War or terrorism affecting security of UK



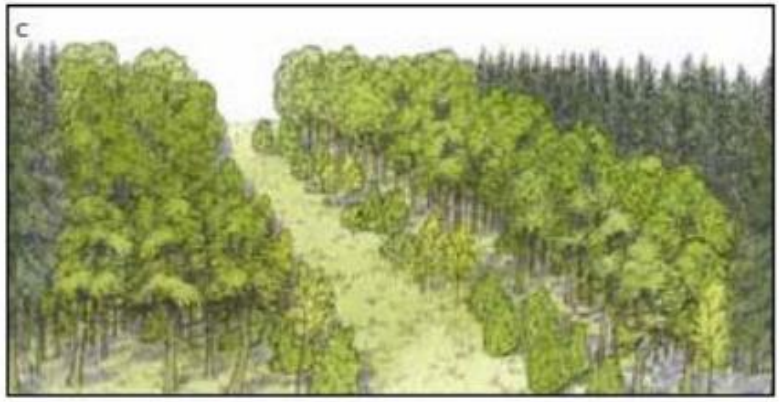

- What other hazards are on the risk register?
  - Pandemic influenza
  - Coastal flooding
  - Terrorist attacks
  - Volcanic eruptions abroad (e.g. Eyjafjallajökull 2010)

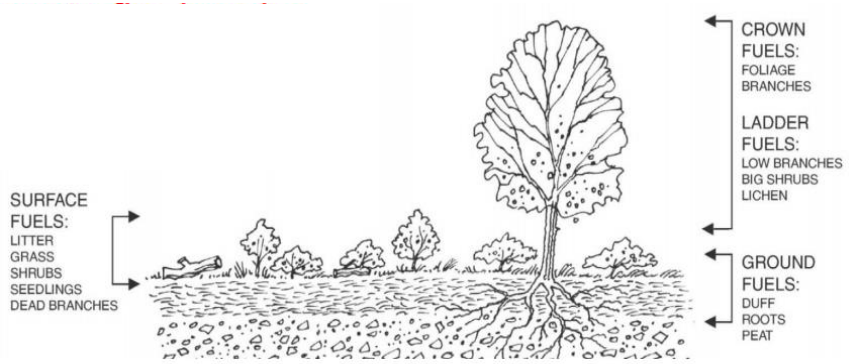
- In 2013, **'severe wildfire'** was added to the register

# Wildfire management

# Fuel management

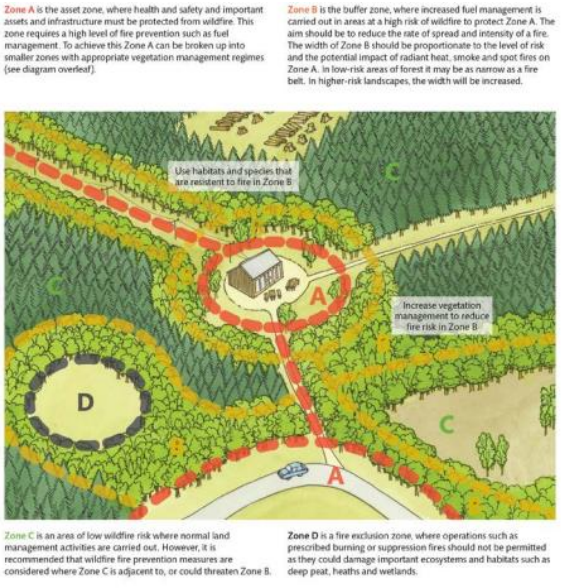
- Amount: biomass
  - Manage with fire, grazing, cutting
- Type: size, especially fine fuels e.g. grass or those with volatile biochemistry e.g. gorse
  - Manage species composition
- Continuity
  - Horizontal: fire breaks
  - Vertical: thin out ladder fuels



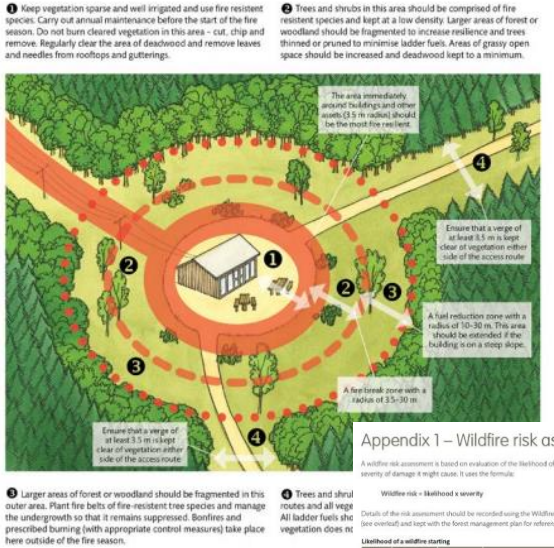



# Forestry commission practical guide

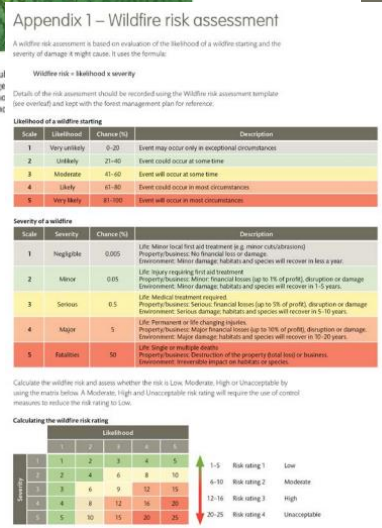
- Forest management plans

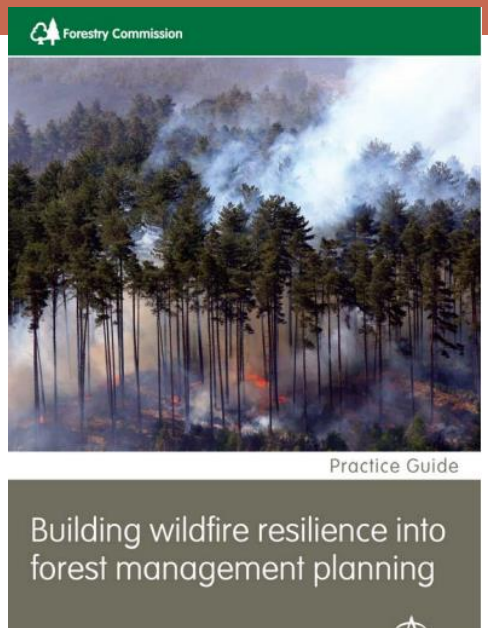



Landscape scale



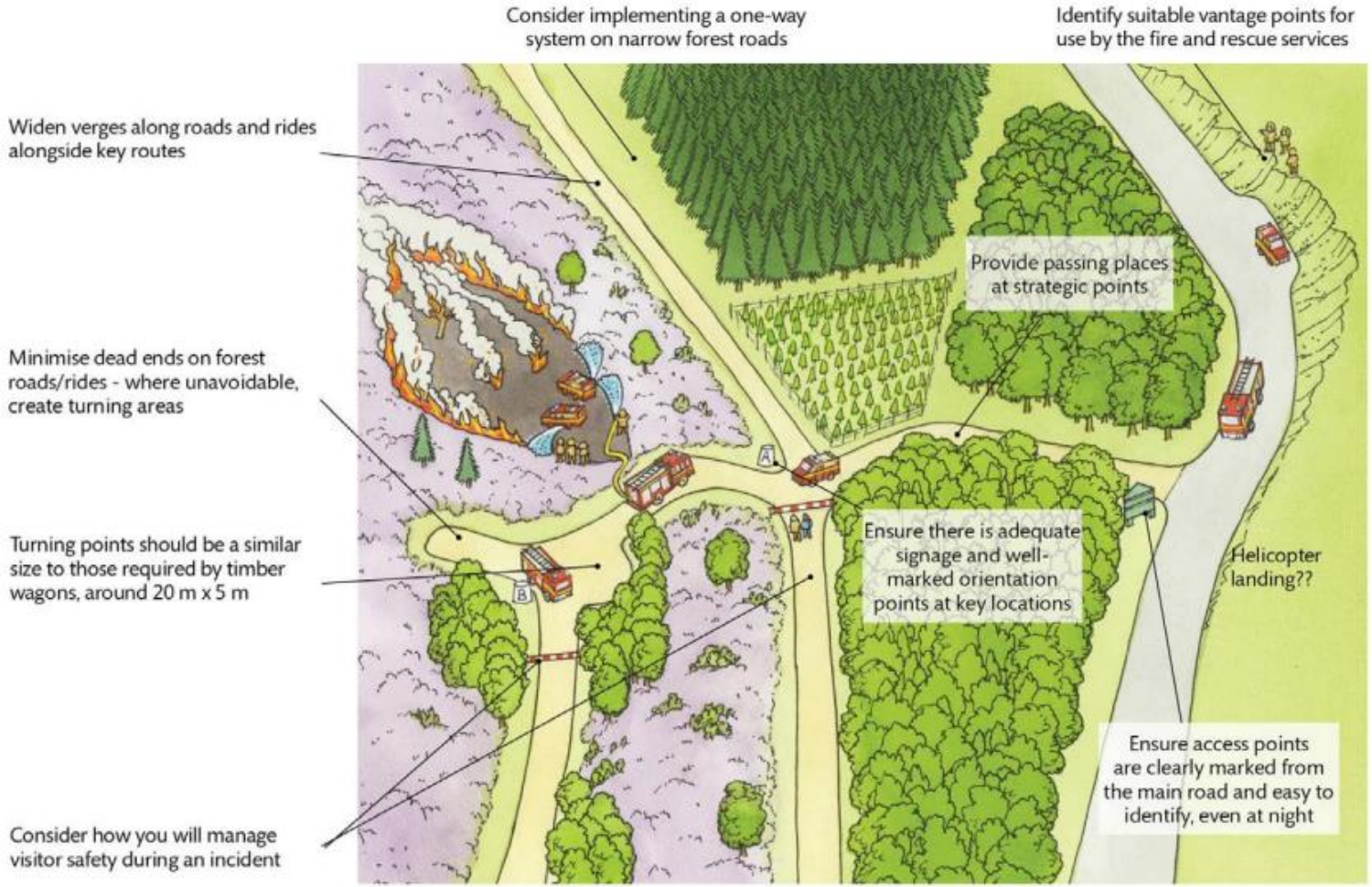

Assets



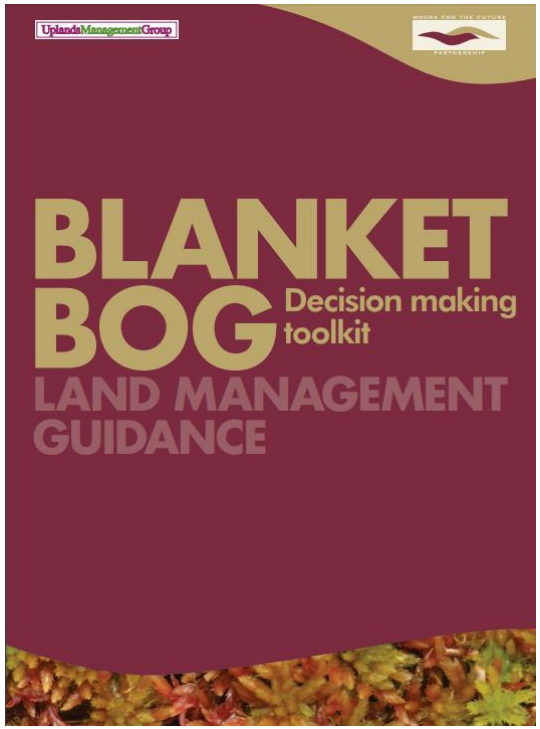

# Forestry commission practical guide

**Figure 22** Planning to facilitate an incident response. All such features should be marked on the Wildfire response plan.



# Land management guidance

- Consider risk of wildfire, in particular:
  - Is there a history of wildfire in the area?
  - Is there vegetation with high fuel loads adjacent to the restoration site?
- Draw up a wildfire management plan
- Monitor changing fuel load



# International examples

- City of Hobart, Tasmania
  - Over 100 urban fuel breaks
  - Periodically assessed and updated
  - Included as part of planning process for new houses

City of HOBART

- Canada
  - Forest Fire Danger Rating System
  - Fire modelling
  - Prescribed burning

Natural Resources Canada | Ressources naturelles Canada

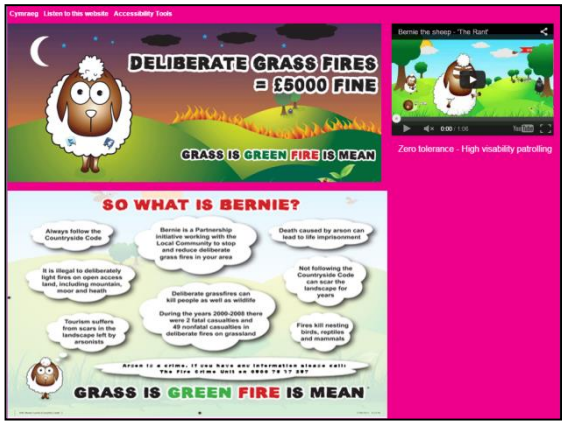
Canada

# Ignition management

- Fire risk warnings
  - Public access, CRoW
- Education programmes
  - School-aged children
- Planning system
  - Rural-urban house building

# Targeted Public information

- Areas of high arson ignitions
  - e.g. South Wales (Jollands et al., 2011)
- Time of high risk
  - E.g. school holidays
- Press releases
- Websites
  - Peak District “Be Fire Aware”

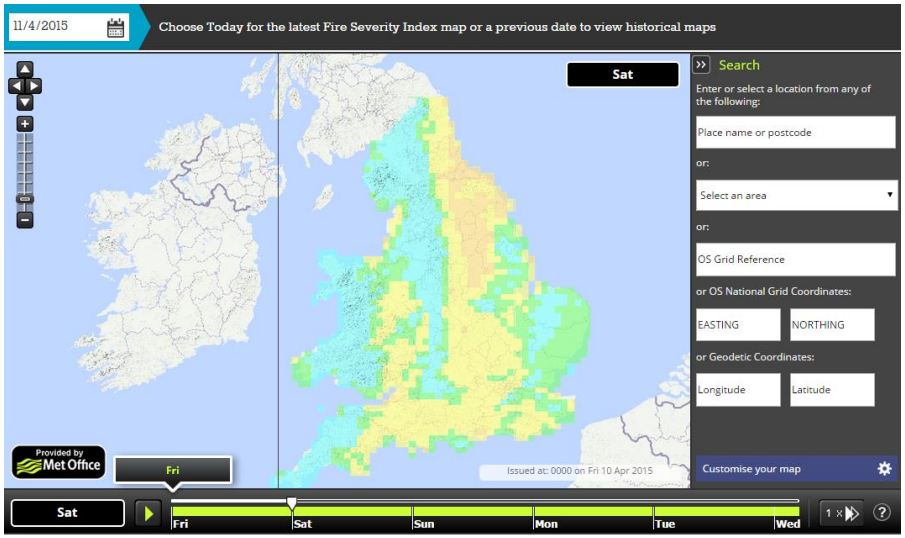


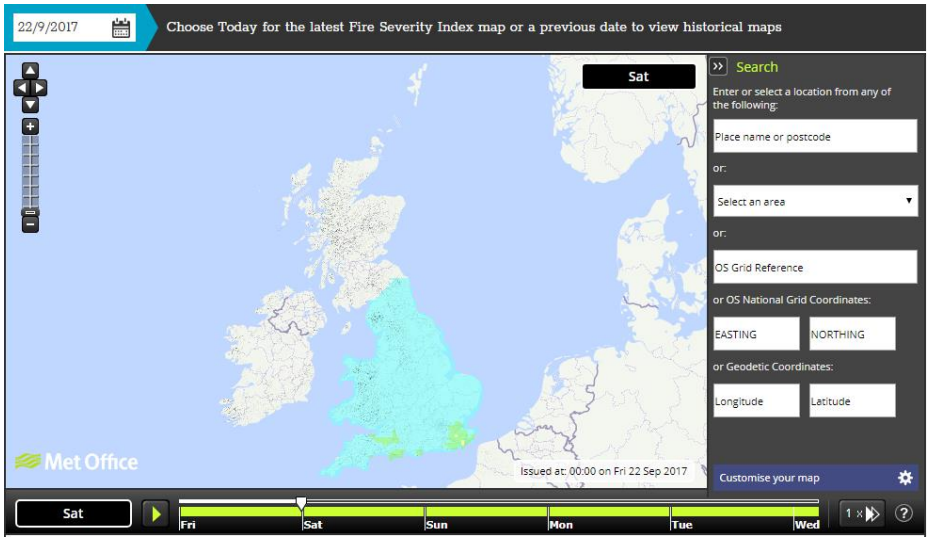

Project Bernie (South Wales)


Flames Aren’t Games (Staffordshire Fire and Rescue Service)

# Fire risk warnings

- Used to highlight periods of high fire risk
  - Allows for closure of open access land in extreme situations
- Met Office Fire Severity Index
  - http://www.metoffice.gov.uk/public/weather/fire-severity-index

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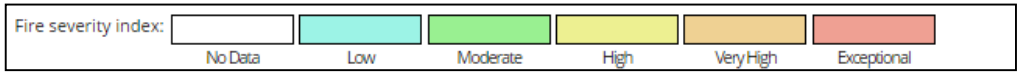
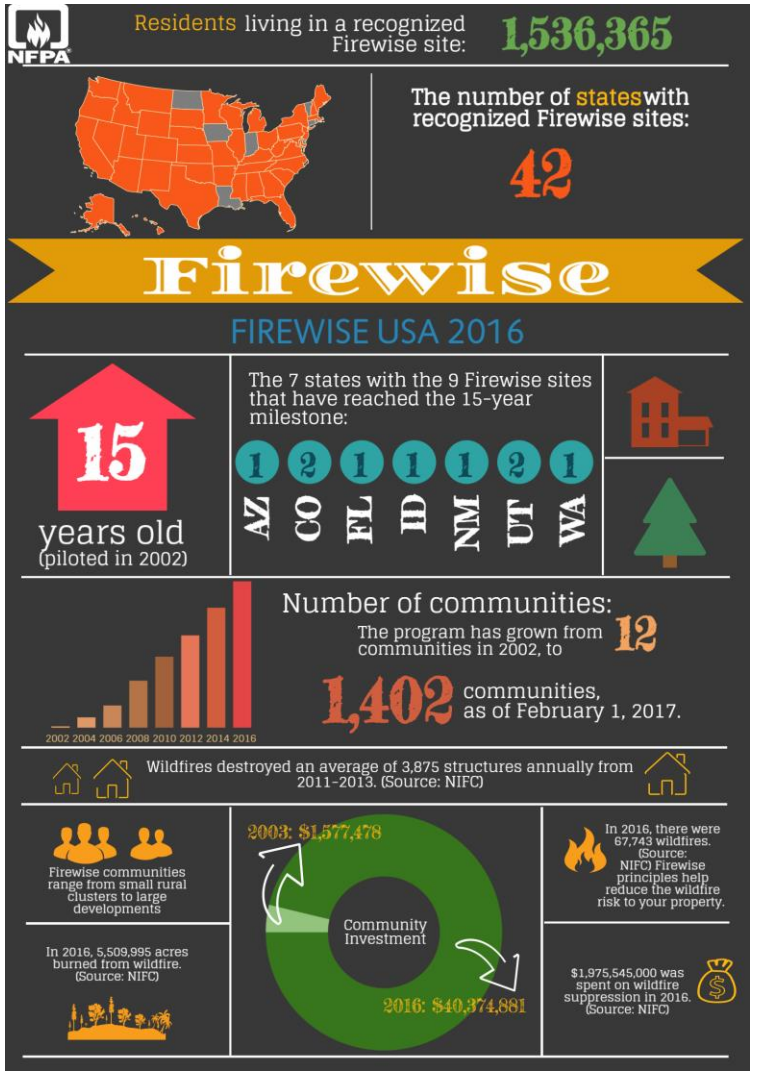



22 Sep 2017

# International examples

- Firewise communities
  - Local solutions
  - Engaging homeowners to take individual responsibility
- Invest $2/capita into action
  - Cash, time, in-kind services etc.
- First UK Firewise community launched in Thursley, Surrey in 2014



# Partnership working

- Evolution of community-based cross-sector working over last 30+ years
  - Bottom-up diffusion to national levels
- Fire groups (e.g. PDNP FOG)
  - Sharing knowledge & collaboration on equipment
  - Varied expertise across the country
    - Northumberland: back burning; PDNP: helicopter suppression
- Many different expectations for land
  - Multiple ecosystem services for multiple groups
  - Can lead to tension and disagreement
  - Wildfire prevention a uniting boundary concept

For a history and more detailed discussion see Gazzard et al. (2016)

# Partnership working

- National level groups
  - Scottish Wildfire Forum (SWF)
  - England and Wales Wildfire Forum (EWWF)
  - Chief Fire Officers Association Wildfire Group

- Knowledge Exchange
  - FireBeaters
  - FIRES seminars
  - Knowledge for Wildfire (KfWf)

# Links & reading

- Knowledge for Wildfire: www.kfwf.org.uk
- EWWF: http://www.northumberland.gov.uk/Fire/Wildfire.aspx
- Gazzard et al. (2016) – Open Access

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Research

**Cite this article:** Gazzard R, McMorrow J, Aylen J. 2016 Wildfire policy and management in England: an evolving response from Fire and Rescue Services, forestry and cross-sector groups. *Phil. Trans. R. Soc. B* **371**: 20150341. http://dx.doi.org/10.1098/rstb.2015.0341

Wildfire policy and management in England: an evolving response from Fire and Rescue Services, forestry and cross-sector groups

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Severe wildfires are an intermittent problem in England. The paper presents the first analysis of wildfire policy, showing its halting evolution over two decades. First efforts to coordinate wildfire management came from local fire operation

# Research questions and challenges

**Key research gaps**

- Link between fire severity and fire history (i.e. PB and WF)
- Trade-offs between prescribed burns and wildfires (all ecosystem services)
- Some social science in UK fire science, but limited

**Opportunities**

- Lots of data (IRS, National Park Rangers, Forestry Commission etc.) → need to archive and join up
- Combine data on prescribed fire and wildfire
  - Better understand the fire regime
- Practitioner science
  - Gather data to increase number, type and geographic coverage of fires recorded

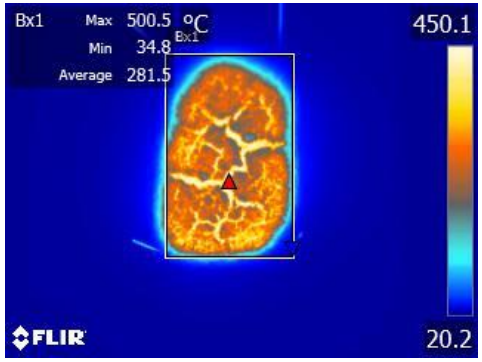
Research synergies should support 'fire resilient landscape design'

- Opportunities to build on partnership working

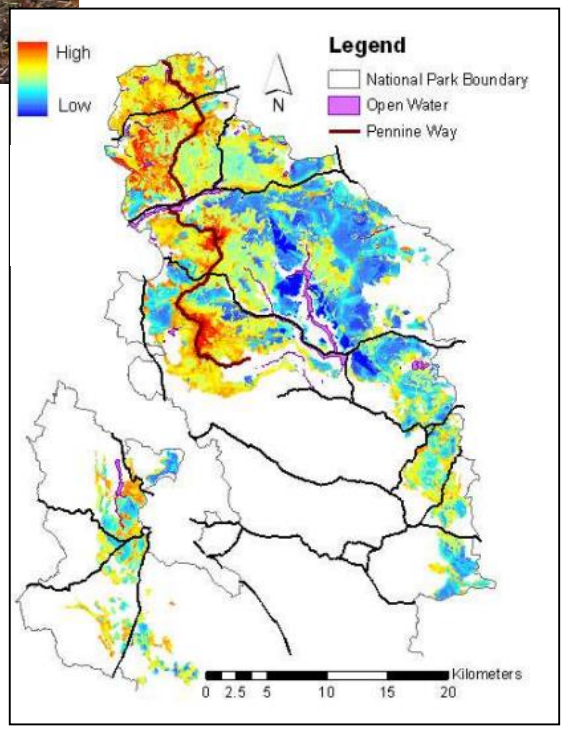
Some outcomes from Workshop at Kings College London, June 2017. Full details at www.kfwf.org.uk

# Fire research at Manchester

- Ecosystem response to fires
  - Carbon dynamics
  - Water quality
  - Heavy metal release




- Spatial mapping of wildfires
  - Understanding their role in the UK




- Knowledge Exchange (www.kfwf.org.uk)
  - Dialogue between academics and organisations such as the Fire and Rescue Service, local and central government, and land managers

# Wildfires 2017

Wildfires 2017
The UK Wildfire Resilience Conference

- Theme: Wildfire resilience in a UK context
- 7 – 8 November
- Royal Bath Hotel in Bournemouth
- https://www.dorsetforyou.gov.uk/uk-wildfire-conference


Thank you

# References


- Albertson, K., Aylen, J., Cavan, G., McMorrow, J. (2010) Climate change and future occurrence of moorland wildfires in the Peak District of the UK. *Climate Research* 45:105-118 [Open Access]
- Bowman, D.M.J.S, Williamson, G.J., Abatzoglou, J.T., Kolden, C.A., Cochrane, M.A., Smith, A.M.S. (2017) Human exposure and sensitivity to globally extreme wildfire events *Nature Ecology & Evolution* 1: 0058
- Doerr, S.H., & Santin, C. (2016) Global trends in wildfire and its impacts: perceptions versus realities in a changing world *Philosophical Transactions of the Royal Society B* 371: 20150345
- Forestry Commission (2014) Building wildfire resilience into forest management planning. Forestry Commission: Edinburgh.
- Gazzard, R., McMorrow, J., Aylen, J. (2016) Wildfire policy and management in England: an evolving response from Fire and Rescue Services, forestry and cross-sector groups. *Philosophical Transactions of the Royal Society B* 371: 20150341 [Open Access]
- Harrison, S.R., Marlon, J.R., & Bartlein, P.J. (2010) Fire in the Earth System. In Dodson, J. (ed) *Changing Climates, Earth Systems and Society*. Netherlands; Springer Science & Business