Fire is an interdisciplinary issue

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

- 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 $\rightarrow$ 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

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
UK Fire regime

- Between 2009/10 and 2012/13
  - 210,000 vegetation fire incidents recorded by FRS

- Rural-urban interface

- Nearly 50% are <5m²

- 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
Impact

Fire Affected Areas

Transport Research Laboratory

Crowthorne village

Broadmoor High Security Hospital
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
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

- Zone A is the most severe, where health and safety and industrial assets and buildings must be protected from wildfires. This zone requires high levels of fire prevention and control management. To achieve this, Zone A can be broken up into smaller zones with appropriate vegetation management regions (see diagram above).

- Zone B is the buffer zone, where increased fire management is carried out to create a low risk of wildfire protection. Zone B aims to reduce the risk of wildfire to a level of safety.

- Zone C is the area with lower risk, where performance-based management is required. The width of Zone C should be proportionate to the level of risk and the potential impact of surface fuel loads and point source on Zone B.

- Zone D is the area of lower risk where normal and management activities are carried out. However, it is recommended that defensible space is maintained within and around these zones to ensure fire safety and minimize risk.

Landscape scale

- Keep vegetation sparse and well managed to reduce the risk of wildfire.

- Trees and shrubs in this area should be cleared off the ground space and the underbrush. Larger areas of forest or woodland should be managed to increase resilience and reduce the potential for rapid spread.

- Regularly clear the area of dead and dry vegetation and control sensible from rooftops and overhangs.

- Ensure there is a minimum of 10 m to clear weeds and undergrowth.

- Areas of high hazard should be cleared and regular maintenance should be undertaken.

- The bare ground should be maintained at least 10 m.

Assets

- Building resilience into forest management planning

- Wildfire risk assessment

- Wildlife risk assessment template with worked example
Figure 22 Planning to facilitate an incident response. All such features should be marked on the Wildfire response plan.

- Consider implementing a one-way system on narrow forest roads
- Identify suitable vantage points for use by the fire and rescue services
- Widen verges along roads and rides alongside key routes
- Minimise dead ends on forest roads/rides - where unavoidable, create turning areas
- Provide passing places at strategic points
- Turning points should be a similar size to those required by timber wagons, around 20 m x 5 m
- Ensure there is adequate signage and well-marked orientation points at key locations
- Consider how you will manage visitor safety during an incident
- Ensure access points are clearly marked from the main road and easy to identify, even at night
- Helicopter landing??
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

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

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

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](http://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

- Theme: Wildfire resilience in a UK context
- 7 – 8 November
- Royal Bath Hotel in Bournemouth
- [https://www.dorsetforyou.gov.uk/uk-wildfire-conference](https://www.dorsetforyou.gov.uk/uk-wildfire-conference)
Thank you
References


