FIRES

Fire Interdisciplinary Research on Ecosystem Services:
Fire and Climate Change in UK Moorlands and Heaths

POLICY BRIEF

KEY MESSAGES

1. **The UK has an under-reported wildfire problem;** an improved evidence base is needed.
2. **Wildfire risk and its causes vary over the UK;** Wildfires are started by humans - accidentally by recreational visitors, transport and escaped managed fires, and maliciously by arsonists. We need to know more about the UK fire regime (date, intensity, duration, size and location and type of vegetation fires) – and how this is changing.
3. **Managed fires and wildfires are linked,** together determining fire regime. Managed fires can reduce wildfire risk by controlling fuel load, but escaped fires can become wildfires.
4. **The impact of fire on ecosystem services is contested.** It varies with fire regime. Severe wildfire should be recognised as an ecosystem disservice, especially in peatlands. Cross-sector cooperation is required to avoid well-intentioned management unwittingly increasing wildfire risk.
5. **Fires are costly to put out, and have long-term cost implications for ecosystem services.** Treating ecosystem services as property assets would allow the costs of suppressing wildfires to be set against the avoided costs of damage to these services.
6. **There are three main challenges to future management** of wildfire risk on moorlands and heaths ; land and recreation management and the effects of climate change.
7. **Wildfire management needs combined strategies** of fire suppression, prevention and protection of ecosystem services, including fuel and risk reduction.
8. **Specialist equipment, training, models and forecasting tools** are needed.
9. **Research and knowledge exchange** on wildfire need to be supported.
10. **Partnership working is an effective and efficient approach** to address the wildfire problem.

Figure 1: Wildfires on the UK, 18 April 2003. Red dots mark the location of active fires detected by the MODIS satellite. Smoke plumes from large moorland fires can be seen. (NASA/University of Maryland[1])

FIRES Seminar Series

The FIRES seminar series discussed the key but equivocal role of prescribed fire and wildfire, and the many controversies for management and policy making. Four seminars were held in 2008/9 on the effects of moorland and heathland fires on ecosystem services in the UK. The series was funded jointly by ESRC and NERC as part of their transdisciplinary series on ecosystem services. Other sponsors included Scottish Natural Heritage, Game and Wildlife Conservation Trust, and the Peak District National Park Authority. Over 130 different people attended; the majority were practitioners. Demand exceeded ESRC/NERC funded places by over 70%.

The environmental, social and cultural ecosystem services provided by moorlands and heathlands include carbon capture and storage (especially on peatland), biodiversity, water provision, flood protection, aesthetic/recreational value, and economic value from tourism, sporting enterprises, forestry and grazing. Fire is historically important in shaping moorland and heathland landscapes. Managed rotational burning is used to maintain heather moors for grouse and grazing animals. Its effect on ecosystem services is contested. Wildfire is accidental or malicious vegetation fire. Severe wildfire increasingly threatens ecosystem services.

This document expands on the key messages from the series, makes policy recommendations and identifies knowledge gaps.

1. An under-reported problem: poor evidence base

Wildfire is a significant semi-natural hazard in the UK. Wildfires occur every year in the UK (Fig. 2), with 71,700 'vegetation fires' of all sizes and types recorded on average between 1974 and 2005[2]. Severe fires can occur in any year, but mainly in drought years such as 1995 and 2003. Yet UK reporting of vegetation fires is poor at national, European and UN level.

The evidence base for vegetation fires is poor because: (i) most vegetation fires do not damage property or cost lives, so, until recently, they have been reported to a lower standard than structural fires; (ii) data collection is not standardised between the 41 regional Fire and Rescue Services (FRS). For moorland fires, we know where the FRS tenders parked, but usually not where the fire actually occurred. Nor do we know the severity of vegetation fires or their confirmed cause. Reporting aggregates types of vegetation fires. From April 2009, the UK-wide Incident Recording System (IRS) should improve reporting. It is being locally implemented, so common core data urgently need to be identified.

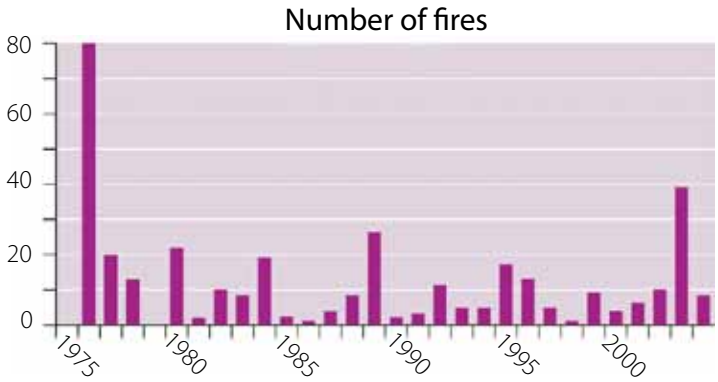

Figure 2: *Wildfire frequency in the Peak District National Park, 1975 to 2004 (based on Peak District National Park Rangers' fire log)*

2. Regional variations in fire regime and cause

Fire regime is the frequency, timing and severity of vegetation fires, including prescribed burns and wildfires. Fire regime varies regionally, but work is needed to describe and define this. Causes of wildfire are also thought to vary regionally. They include escaped prescribed burns, discarded cigarettes and barbecues, sparks from ordnance or trains and arson.

3. The role of land management prescribed burns

Prescribed burns (Fig. 3) can lower wildfire risk by reducing fuel load and creating fire breaks, but can become wildfires if poorly managed. Research is required on their spatial relationship with wildfire over the UK;
are prescribed burns associated with fewer or less severe wildfires, or the reverse? Prescribed burns and wildfires need to be considered together in defining UK fire regimes and how they are changing.

Figure 3: *Prescribed burns (© Geoff Eyre)*

4. An ecosystem disservice?

The impact of fire on biodiversity, carbon budget and water colour is controversial. It can be both positive or negative, depending, for instance, on fire regime. Yet most research relates to single fires. New work is needed on UK fire regimes and their impact on ecosystem services. Ecological impact also depends on the baseline, time scale over which recovery is measured, and management objectives. We need to know the optimum fire regimes to manage different ecosystem services, and how to prioritise between them. In managing ecosystem services, unwanted knock-on effects of an increased risk of severe wildfires must be avoided, and synergies maximised.

POLICY RECOMMENDATIONS

1. **A nationally-consistent wildfire evidence base;** UK-wide standard for reporting vegetation fires within IRS, notably geo-location of the fire ground, and links to other fire databases, such as those utilised by the EU.
2. **Cross-sector wildfire risk assessment;** wildfire hazard management should be recognised on Defra's checklist of ecosystem services[3], and included in risk assessment of land management plans.
3. **Recognition of the economic and social value of all ecosystem services;** calculate avoided costs of damage to ecosystem services to be set against direct costs of wildfire prevention and suppression.
4. **A combined wildfire strategy;** prevention and suppression alongside risk reduction and fuel reduction, including a review of current burning restrictions.

5. Economic costs of fires

Fires are costly and challenge the resilience of FRS to tackle other incidents. One Peak District fire in 2006 took 31 days and a helicopter to suppress at a total cost of around £1million. Helicopters are expensive - but effective if called out early. Long-term implications include loss of ecosystem services and cost of landscape restoration after damage – £2m for one moor in the Peak District since 2003. Prevention and suppression costs need to be set against the cost of avoided damage to ecosystem services. This will require treating ecosystem services as property assets in the same way as buildings.

6. Three linked challenges

Climate is changing and will affect wildfire risk (Fig. 4). Its effects are complex, but are expected to mean more summer droughts with more frequent severe wildfires, like those of 2003, and a later fire season. Warmer, wetter winters are likely to bring increased fuel accumulation and fewer suitable days for prescribed burns. Warmer summers are likely to increase visitor numbers and ignition sources. This will bring further challenges for public access, which is already restricted on Access Land at times of high fire risk. These effects must be considered alongside changes in land management and rural policy. Any policy change which results in increased fuel load or increased public access potentially increases wildfire risk.

5. **Support for partnership working** in Local Fire Groups including:

   (a) A national funding framework for delivering a wildfire strategy, for instance, via the Scottish and English Wildfire Forums;

   (b) Regional or local level coordination by Local Fire Groups to share best practice in training, equipment sharing, burn plans, etc;

   (c) Participation of the research community; and,

   (d) Capacity building, retention of expertise and delivering training at the national level.

6. **Funding of research** to address the knowledge gaps, as identified overleaf.

7. **Regular, frequent monitoring and policy review**, for instance by the English Wildfire Forum and Scottish Wildfire Forum.

Figure 5: Fire and Rescue Services attending a moorland fire at Harbottle, Northumberland, 7 April 2007 (© Steve Miller)

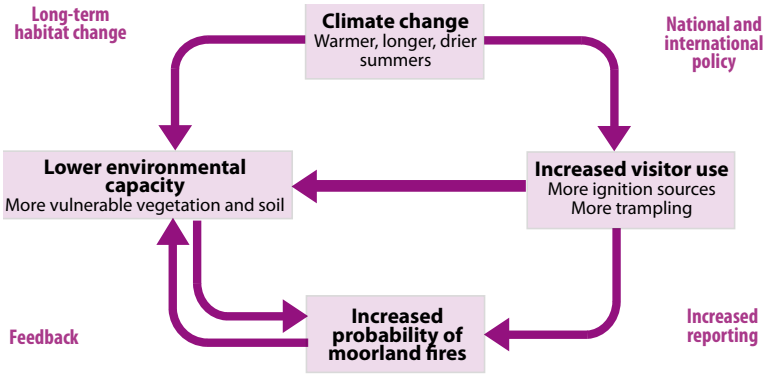

***Figure 4:** Relationship between wildfire, climate change and people*

7. Combined wildfire management strategies

Management of wildfire risk requires a combination of: fuel load reduction; reducing risk of ignition from human sources; reducing the flammability of vegetation in dry conditions; and improving suppression. Over-suppression without other measures increases the risk of severe fires, as has occurred in the USA. Fuel load management is critical. There is a need to review policies which inhibit fuel load management. Land mangers say that current UK land management policy is allowing fuel loads to become dangerously high; evidence is needed.

8. Equipment, training and technical tools

Most FRS are neither well equipped nor well trained to deal with vegetation fires. Research and knowledge exchange on UK fire behaviour, especially for peat fires, is needed to improve the efficiency of fire suppression. Tools for forecasting and modelling wildfire risk in UK conditions are required, ranging from fire risk maps based on past fires (Fig. 6) to an improved fire danger rating system and fire behaviour models for UK conditions.

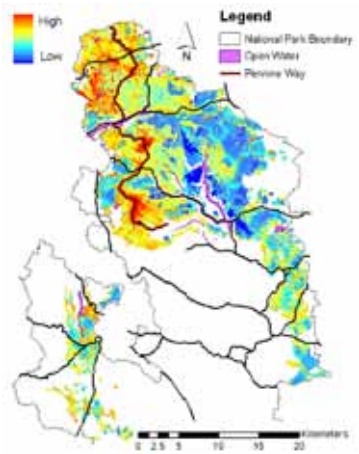

***Figure 6:** Risk of wildfire occurrence in the Peak District National Park, based on 30 years of wildfire records[4]*

9. Research and knowledge exchange

FIRES showed the value of knowledge exchange. New research is also needed. Knowledge gaps are identified overleaf.

10. Partnership working

Partnership working in Local Fire Groups, such as the Fire Operations Group (FOG) in the Peak District National Park, is an efficient and effective 'grass-roots' approach to the wildfire issue. FOG's activities include cross-sector, cross-FRS brigade incident planning, and compatible suppression equipment and techniques. This approach should be supported by central government. It is helpful both in planning, preventing (Fig. 7) and responding after a fire.

Figure 7: Warning signs at a popular access point in the Peak District National Park

KNOWLEDGE GAPS

1. **A comprehensive, accurate, spatially robust and accessible evidence base on UK wildfires:** What core data should all FRS collect of attended vegetation fires within IRS? How can we best combine this with fire databases kept by land owners? Could remotely sensed data usefully contribute?
2. **Acceptable multi-disciplinary criteria for assessing and measuring fire severity:** How should fire impacts on biodiversity, water quality, scheduled ancient monuments, carbon budgets, etc. be assessed? What proportion of prescribed burn and wildfire burn scars show signs of severe burning; i.e. are prescribed burns always mild burns and are all wildfires always severe burns?
3. **Changing regional fire regimes:** What is the relationship between frequency, severity and timing of prescribed burning to that of wildfires? Are prescribed burns associated with fewer and less severe wildfires, or with more frequent and severe wildfires? Does this vary over the UK? How are changes in land use and grazing intensity, etc. affecting fuel load and wildfire?
4. **Appropriate fire regimes:** What fire regimes are needed to achieve management objectives for each ecosystem service under climate change scenarios?
5. **Synergy and conflict between policies:** To what extent do policies for managing single ecosystem services conflict with or reinforce polices for managing wildfire? How can we manage this interaction?
6. **Appropriate costing tools for ecosystem services:** especially for non-use regulating and cultural ecosystem services: Using these tools, what are the indirect costs of a vegetation fire on ecosystem services relative to the direct costs of fire-fighting and active fire prevention?
7. **Stakeholders' attitudes to wildfire:** Are attitudes changing in response to climate change scenarios and changes in the rural economy? What evidence is there that climate change actually increases visitor pressure and the incidence of fire? What is the best way of minimising arson and accidental fires?
8. **Improved technical tools for UK conditions:** including a better UK-wide fire danger rating system, especially one which can be used to guide timing of prescribed burns; fire behaviour models suited to UK and peat fires; spatial fire risk mapping based on historic data.
9. **Knowledge exchange and research partnerships with fire managers:** Topics include vegetation fire behaviour, tactics for fighting wildfires (including use of suppression fire), use of geospatial technologies such as GPS and visualisation, and knowledge required to complete compulsory key data fields in IRS.

References

1. NASA/University of Maryland. (2002) MODIS Hotspot / Active Fire Detections. Data set. MODIS Rapid Response Project, NASA/GSFC [producer], University of Maryland, Fire Information for Resource Management System [distributors]. Available on-line [http://maps.geog.umd.edu]
2. Office of the Deputy Prime Minister (2007) Fire Statistics 2005. http://www.communities.gov.uk/documents/fire/pdf/144524
3. Defra (2007). An introductory guide to valuing ecosystem services. Defra, London.
4. McMorrow, J. M. and Lindley, S. J. (2007). Modelling the spatial risk of moorland wildfire. Report for Moors for the Future Partnership, Edale and Peak District FOG.

Steering Group

Julia McMorrow, The University of Manchester;
Colin Legg, University of Edinburgh;
Jonathan Aylen, The University of Manchester;
Jonathan Walker, Moors for the Future Partnership;
Klaus Hubacek, University of Leeds;
Claire Quinn, University of Leeds;
Simon Thorp, The Heather Trust;
Marion Thomson, The Heather Trust;
Mark Jones, Chief Fire Officers' Association;
Gina Cavan, The University of Manchester.

Contact: Julia McMorrow, julia.mcmorrow@manchester.ac.uk

Figure 8: *Experimental gorse fire (© Colin Legg)*

Website: www.fires-seminars.org.uk

Views expressed in this document do not necessarily reflect those of sponsors