Institution: The University of Manchester

Unit of Assessment: 17a (Geography)

Title of case study:
Policy Support for Wildfire Management and Contingency Planning in the United Kingdom

1. Summary of the impact

Wildfire was barely recognised as a significant hazard in the UK prior to University of Manchester (UoM) research, that significantly changed stakeholders' and national policy-makers' awareness. This work on mapping and forecasting moorland wildfire risk has informed the Cabinet Office, and has demonstrated clear impact on fire preparedness planning in the Peak District National Park (where it is estimated that a large fire is potentially avoided each year). Following an ESRC-NERC seminar series (FIRES), the England and Wales Wildfire Forum (EWWF) was established, with EWWF persuading Government to further amend national policy on wildfire. This impact is ongoing, with DEFRA including wildfire in its 'National Adaptation Programme', and the Cabinet Office recently including wildfire within the 'National Risk Assessment' framework.

2. Underpinning research

This impact case is based upon research that has taken place at UoM (2004-), led by geographical information scientist, Julia McMorrow (Geography, 1991-), and an interdisciplinary team including: meteorologist, Dr Gina Cavan (Geography, 2009-2012); economist, Jonathan Aylen (Manchester Business School, 2001-); geographical information scientist, Dr Sarah Lindley (Geography, 2001-); and econometrician, Dr Kevin Albertson (Manchester Metropolitan University).

Wildfires are unwanted vegetation fires requiring intervention. UK response costs are estimated at £55m a year, with up to £1m per single big moorland fire. The initial aim of the research was to understand the spatial distribution and timing of moorland wildfire risk. Beginning locally, a spatial model was developed to predict wildfire risk in the Peak District National Park (PDNP) as part of the DEFRA-funded 'Climate Change and the Visitor Economy' project [E]. It was recognised that wildfires are also a social and environmental issue, spanning economics, psychology, ecology, physical and human geography and fire science. Accordingly, this was the first time that human (access) and biophysical factors (fuel, topography) were modelled holistically for UK fires. Furthermore, the research was an example of successfully co-produced knowledge, as model inputs and parameters were developed in two risk workshops alongside key stakeholders from the PDNP 'Fire Operations Group', including fire officers, PDNP rangers and Natural England. Taken as a whole, the research produced:

- **A novel method to extrapolate sparse path popularity data over the whole footpath network**, as fire occurrence showed a strong positive correlation with distance from popular sections of footpaths [D].
- **Outputs with direct policy relevance, through the production of fire risk maps and recommendations around minimising risk and contingency planning for fire prevention, preparedness and response**. These included: identifying high risk areas where new fire ponds and fire watches were needed [D]; protocols to improve fire recording (i.e. ignition point and locational precision); and cross-referencing to Fire and Rescue Service (FRS) records.
- **A temporal model for forecasting the probability of wildfire occurrence in the PDNP based on temperature and rainfall data and visitor activity** [C]. This was novel as it included human factors (e.g. school and bank holidays), and was also the first application of an advanced time series econometric technique (*Probit*) to fire occurrence data. The model was further developed (combined with UKCIP simulated weather data) in order to assess impacts of climate warming on wildfire incidence [B]. Put simply, the model predicted increased incidence of moorland wildfire under conditions of warmer, drier summers, signalling the consequent risk of significant damage to moorland ecosystems and associated ecosystem services.

As a whole, the PDNP research demonstrated a new approach to determining wildfire risk and management options. It also demonstrated the importance of climatic and land use factors in determining overall risk and assessed management options within this risk framework. The impact of this research led to a second research phase – national action research within three knowledge

exchange initiatives: EWWF, FIRES and a NERC 'Knowledge Exchange Fellowship' [A]. Taken together, a two-way cyclical knowledge exchange has demonstrated direct and indirect impacts of national reach and significance.

3. References to the research (all references available upon request - AUR)

The research has been published in academic journals, such as the highly regarded *Journal of Environmental Management*, and as specialist research and peer-refereed book chapters.

[A] (2011) McMorrow J. "Wildfire in the UK: Status and Key Issues" in McCaffrey S.M, & Fisher C.L. (eds.) *Proceedings of Second Conference on the Human Dimensions of Wildland Fire* (U.S. Department of Agriculture, Forest Service) 44-56 (AUR)
[B] (2010) Albertson K., Aylen J., Cavan G. & McMorrow J. "Climate Change and the Future Occurrence of Moorland Wildfires in the Peak District of the UK" *Climate Research* 45 (Special 24) 105-118* doi:10.3354/cr00926
[C] (2009) Albertson K., Aylen J., Cavan G. & McMorrow J. (2009) "Forecasting the Outbreak of Moorland Wildfires in the English Peak District" *Journal of Environmental Management* 90(8) 2642-2651* doi:10.1016/j.jenvman.2009.02.011
[D] (2009) McMorrow J., Lindley S., Aylen J., Cavan G., Albertson K., & Boys D. "Moorland Wildfire Risk, Visitors and Climate Change: Patterns, Prevention and Policy" in Bonn, A., Allott, T., Hubacek K. & Stewart J. (eds.) *Drivers of Change in Upland Environments* (Routledge: London) 404–431 (AUR)
[E] (2005) McMorrow J., *et al* 'Climate Change and the Visitor Economy – Technical report 3: Moorland Wild Fires in the Peak District National Park' (CURE: UoM) 88pp (AUR)

[* Albertson contributed to forecasting research - first-named alphabetically, but not lead author]

4. Details of the impact

Context: Prior to this research, wildfire was barely recognised as a significant semi-natural hazard in the UK, despite UK Fire and Rescue Services recording on average 70,000 'grassland' fires a year [1]. The research outlined above, undertaken alongside PDNP, has led the way in gaining recognition by national policymakers of wildfire as a hazard, ultimately changing the way wildfire is recorded. The Cabinet Office acknowledges the importance of this change, noting that McMorrow was *"one of the first experts consulted by the CCS Olympic Team about possible wildfire risk to the Olympics…* [her] *work has been paramount in getting wildfire and its management recognised on the National Risk Assessment"* [2].

Impact 1 – PDNP: More specifically the research has had tangible direct impacts on fire preparedness planning in the PDNP. As they attest, this has led to radical policy change:

> *The mapping and forecasting work was based on our unique >37 year record of wildfires recorded in the PDNP Rangers fire log. We have taken up Julia's recommendations for improving the way in which we record the geo-location of fires and fire perimeters, and for linking our records to Fire Service incident data. It has added value to the Rangers fire log for further GIS analysis, and is an example of how co-produced applied research can feed back to improving capacity for future research. Other local fire groups have also taken up these recommendations (for instance, West Yorkshire Fire and Rescue Service now record wildfire perimeters)… We have also published a Research Note on the wildfire risk mapping as a way of reaching other practitioners.* [3]

In particular, risk mapping has assisted in three key ways:

1. **Forming the basis for planning the 'ranger early wildfire warning system'** which has already been estimated to have averted five large fire incidents, each with potential fire-fighting costs of up to £1M, and threatening >£16M investment in peatland restoration (£8M to date; £8M to 2015). UoM research provided the evidential basis for siting fire ponds and a full

assessment of water resources for fire fighting [D]; PDNP's Science Programme Manager subsequently verifying that: "*This best practice in turn is leading to economic and societal benefits in operational cost and protection from loss of amenity, extending well beyond the Peak District to other National Parks and upland areas of the United Kingdom"* [3].

2. **Recommendations on recording wildfire geo-location and cross-referencing were followed**, resulting in a more spatially robust, co-ordinated database [3].
3. **Forecasting and mapping outputs are now being combined by contractors**, towards the development of an interactive exhibit for the Moorland Centre. The goal is to raise public awareness of the increased wildfire risk resulting from climate change [3].

Impact 2 – FIRES/EWWF: Work with PDNP led to the ESRC-NERC funded Fire Interdisciplinary Research on Ecosystem Services (FIRES) seminar series, convened by McMorrow, with the PDNP's 'Moors for the Future' stakeholder partnership as co-investigators. FIRES brought together scientists, policy-makers and practitioners, and for the first time included significant input from the regional Fire and Rescue Services. The output from this series was an influential co-produced policy brief [1], circulated within the Cabinet Office [2]. As the Chair of the 'Chief Fire Officers Wildfire Group' confirms: *"Such was the quality of the Policy Brief, that I used it to raise the awareness of wildfire issues affecting UK FRS's by circulating it to all Chief Fire Officers and members of the Chief Fire and Rescue Advisors Unit at the Department for Communities and Local Government (DCLG). This continues to be the case, and the work is as relevant now as it was when first produced in 2010. The FIRES Policy Brief also formed a cornerstone of the initial CFOA Wildfire Group's initial Action Plan*" [4].

FIRES created impact in the form of social capital, building a wide community of stakeholders that ultimately helped the English Wildfire Forum to expand into a new England and Wales Wildfire Forum (EWWF) and become a more pro-active 'community of practice', unusual by virtue of its 'cross-sector' composition [4]. EWWF now has >25 members from: English and Welsh Central Government (the Cabinet Office, Department for Communities and Local Government {DCLG}, Ministry of Defence, *etcetera*); Department for Environment, Food and Rural Affairs (DEFRA) agencies (the Met Office, the Forestry Commission, Natural England); Fire services; NGOs; and private sector land management groups. Currently led by the Northumberland Fire and Rescue Service, it has quickly become the 'go to' body that Government turns to for advice on wildfire. McMorrow was one of only two academics invited to join, based on her key role within FIRES (including a follow-on survey of stakeholder priorities, emerging from the key messages within the policy brief). In the words of the *Cabinet Office*: "*She has been an important and influential member of that group ever since* [joining], *giving it academic vision and authority and contributing to many of the excellent products from the group. It is clear that her knowledge and expertise has been invaluable in moving the group into an evidence-based, cross-cutting body, on whom the UK may come to rely during any wildfire outbreak… She has already offered the Cabinet Office, DCLG and DEFRA great assistance with regard to wildfire"* [2]. Additionally, EWWF:

- **Distributed the FIRES policy brief** to all Chief Fire Officers and members of the Chief Fire and Rescue Advisors Unit at DCLG [4]
- **Cited recommendations from the FIRES policy brief** in their written evidence to the Select Committee on Rural Affairs on the Natural Environment White paper in 2011 [5]

Impact 3 – FIRES/NERC: One of the key findings of the FIRES policy brief was that fire reporting standards were a barrier to evidence-based policy delivery. This finding was strongly influenced by experience gained from stakeholder-driven data collection. As a result of this finding, McMorrow was invited by the Chief Fire Officers Association wildfire group: to work on improvements to the FRS Incident Recording System (IRS); to ensure robust wildfire reporting in support of 'Community Risk Registers' and 'Integrated Risk Management Plans'; and to evaluate IRS data for GIS analysis of national wildfire risk. As confirmed, McMorrow is *"currently one of only two experts invited to advise this group…* [her] *experience of working with Incident Recording System (IRS) data and using GIS to analyse it, has been integral to the current IRS review process"* [6]. This approach has since been taken up by the Forestry Commission for DEFRA. This led to subsequent invitations to join DCLG's Fire and Rescue Statistics User Group – a group who advise on changes to IRS – as well as the Fire Sector Federation's 'Fire Research and Statistics Forum' [4]. In 2013,

Natural England invited McMorrow to join DEFRA's Best Practice Burning Group – the stakeholder group tasked with developing the 'Heather and Grass Burning Code' for moorland managers – where she is currently co-developing a best practice guide on the reduction of moorland wildfire risk.

FIRES has promoted a step-change in partnership activity [3], with UoM setting up a number of experimental field burns, alongside three regional Fire and Rescue Services (Northumberland, Greater Manchester and Dorset) and five UK universities. This led to KCL's NERC project and a new SME (*FireLab*) [4], which would have been unlikely without FIRES bringing together Fire Officers and academics, notably at the FIRES3 meeting on modelling and forecasting. Moreover, the Dorset experimental burns were featured on the CBBC 'Fierce Earth' programme [4].

Impact 4 – International Influence: Through her research, and the subsequent links developed between the policy and practice aspects of wildfire research, McMorrow was appointed as an NERC Knowledge Exchange Fellow in order to further exploit her unique standing [3]. This has served to progressively integrate research findings into policy and practice, propagating the research more widely. In addition to a treatise on 'Wildfire in the UK' being included in a U.S. Department of Agriculture, Forest Service report [A], the Irish Forest service have also noted that: *"the recent direct involvement of Ms. McMorrow with one of our current wildfire policy actions… led to a rapid acceleration and completion… and considerable savings to our department in terms of time and public resources… a direct consequence of Ms. McMorrow's knowledge"* [7].

Impact 5 – National Policy: In 2009 McMorrow was asked to assist in the drafting of a response to DEFRA's Climate Change Risk Assessment. This resulted in a change of national policy, with DEFRA including wildfire in its National Adaptation Programme [8]. Two years later, McMorrow's expertise proved vital after the April 2011 fires across the home nations (e.g. Swinley Forest in Berkshire, Anglezarke in Lancashire and the Highlands and Islands of Scotland). In the words of the Cabinet Office's Civil Contingency Secretariat (CCS)*: "Fire and Rescue Services were stretched to respond. A select and trusted group of the EWWF were called upon to advise government, both to the response and recovery aspects of this event and Julia was one of the first people called. Her mapping skills and knowledge were extremely important"*. In 2012, the Cabinet Office agreed to include wildfire in the 'Olympic Risk Register', and as noted McMorrow was one of the first experts contacted by the Government [2]. Finally, in 2013 it was announced that wildfire would be included in the 'National Risk Assessment' – a move directly attributable to McMorrow's research. As noted by the CCS, the increasingly use of data from space was a catalyst for this decision, with McMorrow's 'long-standing involvement' in the UK Earth observation Community a key factor [2][4]. Research impact continues to grow as risk assessments are rolled out through 'Local Resilience Forums' and regional Fire and Rescue Authorities. Furthermore, McMorrow's research and knowledge exchange activities around wildfire continue to influence local practice and national policy, with an increasing emphasis on the link between climate change and risk management, as "*the risk of wildfires… is expected to increase in future, with hotter, drier summers"* [9].

5. Sources to corroborate the impact (all claims referenced in the text)

[1] (2010) McMorrow, J. et al 'FIRES: Policy Brief', University of Manchester
[2] Testimonial from Civil Contingencies Secretariat, Cabinet Office (April 2013)
[3] Testimonial from Science Programme Manager, PDNP (7th July 2013)
[4] Testimonial from Chair, Chief Fire Officers Wildfire Group (8th July 2013); (2011) Hedley P 'Towards a New Lexicon' *Wildfire Magazine* (1st May) pp.14-17
[5] (2011) Environment, Food and Rural Affairs Committee 'Written evidence submitted by the England and Wales Wildfire Forum' (26th September)
[6] Testimonial from Senior GIS developer, Dorset County Council (8th July 2013)
[7] Testimonial from Forestry Inspector, Irish Forest Service (25th October 2011)
[8] (2009) DEFRA 'Adapting to Climate Change: UK Climate Projections' (p.21)
[9] (2009) ENPA 'Statement on Climate Change in National Parks' (p.12)