Should Prescribed Fire be used on UK Peatlands?

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1. Climate Change

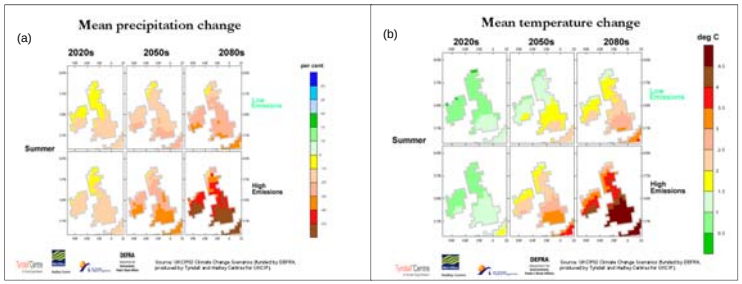

Figure 1: (a) Mean summer precipitation change and (b) mean summer temperature change for high and low emission scenarios for the UK (UKCIP02)

Figure 2: Smouldering peat Rothiemurchus Scotland 2006 (photo: Colin Legg)

Climate change (warmer and drier summers in the UK; Figure 1) is leading to increased fire frequency[1]. Land use change, e.g. reduction in grazing and management fires, has also resulted in an increased fire hazard. Particularly problematic are large intense fires which ignite the peat (Figure 2) these are often difficult to control and impact upon biodiversity, carbon cycle processes, livelihoods and human life. Management by frequent small-scale prescribed fires reduces fuel load and hence the risk of damaging wildfires[2]. Concern over the environmental impact of changes to fire regimes (i.e. frequency, intensity, size, season) is, compounded by a lack of data on the impacts of fire regime on biodiversity, soil erosion, water quality, carbon sequestration and other ecosystem services in peatlands. Given this, should prescribed fire be used on UK peatlands to mange fire risk?

2. Vegetation – Fuel Load

Figure 3: (a) 'Traditional' perception of *Sphagnum* dominated peatland vegetation (b) dense *Calluna* canopy on a peatland in the Scottish Borders

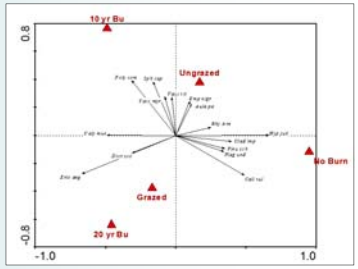

Figure 4: Axes 1 and 2 of a redundancy analysis of vegetation (% cover) from the Hard Hill experimental plots at Moor House, Pennines, England, with 0, 10 and 20 year fire rotations and grazed and un-grazed treatments. Axis 1 $p < 0.001$.

The 'traditional' perception of a peatland is of a fire free wet *Sphagnum* dominated area, however in the UK, many deep peat areas are covered by dense canopies of *Calluna vulgaris* (Figure 3). Climate change may increase this vegetation which in turn may also increase peatland fire risk. Prescribed fire can be used to alter vegetation composition (Figure 4) thus manage fuel loads. With a lower fuel load the risk of damaging intense fires may be lessened. Peatland patterning (e.g. hummocks hollows and pools) appears to involve many processes[3] (e.g. climate and hydrology), however, fire has rarely been considered as a contributory factor, it may be that a differential response to fire is also crucial.

3. Carbon Losses and Gains

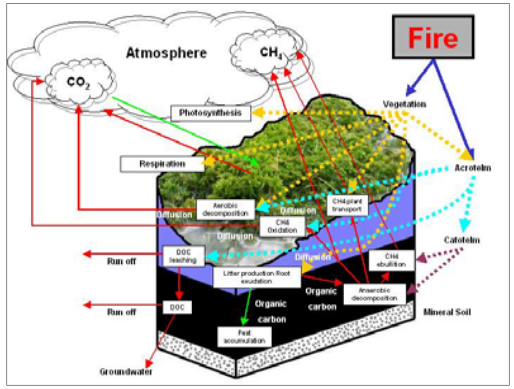

Figure 5: The potential of fire to disrupt the peatland carbon cycle. Carbon Losses (red) Carbon gains (green direct fire effects Blue solid) indirect effects (dashed lines)

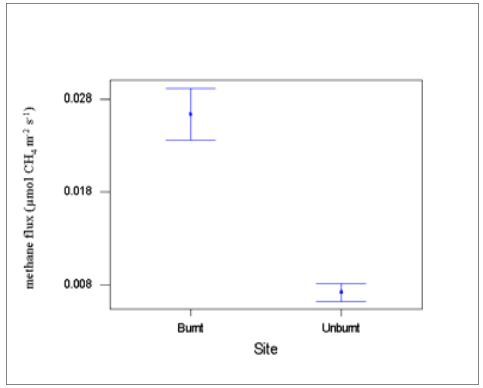

Figure 6: Mean methane fluxes (+/- SE) recorded from chambers every month for 4 months post fire. The paired burnt and unburnt site is located near Forsinard in northern Scotland

Fire has the potential to affect all aspects of the peatland carbon cycle (Figure 5) and undoubtedly leads to initial losses of carbon. However, does post fire vegetation fix carbon at a higher or lower rate than pre-fire vegetation? How long does this persist? Fire may also lead to an increase in methane flux (Figure 6). The mechanisms for this rise are unknown but may include alterations to the microbial community, nutrient inputs and vegetation composition. At present, the debate surrounding fire and the peatland carbon cycle remains hypothetical, as applied research is lacking.

4. Research

The use of prescribed fire is currently discouraged on UK peatlands[3] but there is an urgent need for applied research to inform management practice and policy, particularly in the light of climate change. Research on prescribed fires in peatlands might include such questions as:

1. When, and at what frequency, is prescribed fire good and when is it better to risk accidental wildfire?
2. What are the effects of using prescribed fire on UK peatland biodiversity?
3. How are other ecosystem services affected by the use of prescribed fire?
4. How does the interaction between prescribed fire and grazing impact on peatlands?
5. How does fire affect microbial activity and community composition?
6. What are the long and short term implications for the use of fire on peatland carbon cycle processes?
7. What are the social consequences of either using or not using prescribed fire in peatlands?

References: (1) IPCC, (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability.* CUP, Cambridge, UK. **(2)** Goldammer, J.G., et al., (2007). *The Eurasian Fire in Nature Conservation Network:* http://www.fire.uni-freiburg.de/sevilla-2007/contributions/index.htm. **(3)** Rydin H and Jeglum J.K., (2006) The Biology of Peatlands. OUP, Oxford UK. **(4)** Anon (2001).*The Muirburn Code*. Scottish Executive.