VARIATION IN FIRE SEVERITY AND THE ECOLOGICAL IMPACT OF WILDFIRES

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Marston Moor wildfire 2011
Photo by Samuel Ward

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Background

Spring 2011 & 2012

- Unusually warm and dry Peatland wildfires across the UK
- High severity including peat fires
• A single fire occurs within the context of a **Fire Regime**
• Fire behaviour can vary substantially within and between burns

**Fires vary with regards to...**

- **Intensity**
- **Severity**
- **Ecosystem Response**
• Late-building phase heather (fuel height $\approx 30$ cm)

• Mature heather (fuel height $\approx 45$ cm)
Objectives

1. Develop method to describe the severity of peatland wildfires
2. Estimate carbon losses due to combustion
3. Determine fire effects on soil carbon fluxes (methane, carbon dioxide)
4. Quantify fire effects on biodiversity

Methods

1. Select study sites
2. Evaluate fire severity
3. Estimate fuel consumption
4. Record soil gas fluxes
1. Study sites

- 6 fires burnt in 2011/12 selected
- Fire perimeters mapped
- Initial “look-see” survey of variation in severity
- Record locations for further study

2. Evaluating fire severity

- Adapted the “Composite Burn Index” developed in the United States
- Multiple 20 m diameter permanent CBI plot pairs in each fire
- Formed the basis for monitoring ecosystem response
2. Evaluating fire severity

2. Evaluating fire severity: CBI

**Strata 1 – Substrates:**
- Litter/light fuel consumed
- Peat consumed
- Exposed mineral soil
- *Sphagnum* damage
- Moss scorch/consumption
- *Sphagnum/Moss* survival
2. Evaluating fire severity: CBI

**Strata 2 – Herbs/shrubs:**
- Shrubs top-Killed
- Fine/Crown fuel consumed
- Frequency living
- Colonizers
- Compositional change
- Shrubs resprouting

3. Estimating fuel consumption

![Diagram showing fuel consumption zones](image)
3. Fuel consumption

Harvested fuel sorted by:
• Species and/or life-form
• State (live or dead)
• Size class

We have analysed (so far):
• Total fuel consumption
• Carbon released
• Combustion completeness (proportion of fuel consumed)

3. Recording soil gas fluxes
3. Recording soil gas fluxes

- Gas flux chambers
- Vegetation removed from within chambers
- Sampling in June, July and August
- Measured methane and carbon dioxide

Results (so far)

1. Fire severity
2. Fuel consumption
3. Soil carbon fluxes
4. Microclimatological effects
Variation in fire severity

- Average CBI varied more than **two-fold between** fires
- CBI varied up to **three-fold within** fires

Fuel consumption
Fuel load (kg/m²)

Fuel consumption

Carbon release (T C/ha)

Unburnt
Burnt

A2 A3 F2 F3 M1 M2 S1 S2 W1 W2

Anglezarke Marsden Loch Doon Wainstalls
Soil carbon fluxes

CO₂ flux

Burnt
Unburnt

Microclimato logical effects

• iButton temperature loggers
• 2 cm below top of peat
In the pipeline...

1. Finer-scale analysis of fuel consumption
2. Vegetation dynamics
3. Examining fire weather (e.g. MOFSI) effects
4. Modelling gas fluxes and vegetation change

CONCLUSIONS

• Modified CBI allows quick assessment of fire severity post-burn
• Fire severity varies within and between burns

• Variation in fire severity occurs alongside differences in post-fire ecosystem responses
• Replicate research across and within fires
• Interpret results in context of monitoring effort

Photo by Samuel Ward

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