University of Glasgow | College of Social Sciences
Solway Centre

Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

NATURAL ENVIRONMENT RESEARCH COUNCIL

VARIATION IN FIRE SEVERITY AND THE ECOLOGICAL IMPACT OF WILDFIRES

Gwilym (Matt) Davies
Alan Gray
Rut Domench Jardi
Paul Johnson

Marsden Moor wildfire 2011
Photo by Samuel Ward

Acknowledgements

- Emily Taylor, Sophie Philbrick, Roger Grau (field/lab assistance)
- Julia McMorrow
- England & Wales Wildfire Forum
- All those who contributed data/information

Acknowledgements - landowners

- Yorkshire Water
  - Bo Scholefield & Carl Prenton
- United Utilities
  - Ian Harper & Kate Snow
- National Trust
  - Gemma Wren & Judith Patrick
- Forestry Commission Scotland
  - Rob Soutar & Andrew Jarrott
- Finzean Estate
  - Andrew Farquharson & Paul Chapman (SAC)
- Birse Community Trust

Background

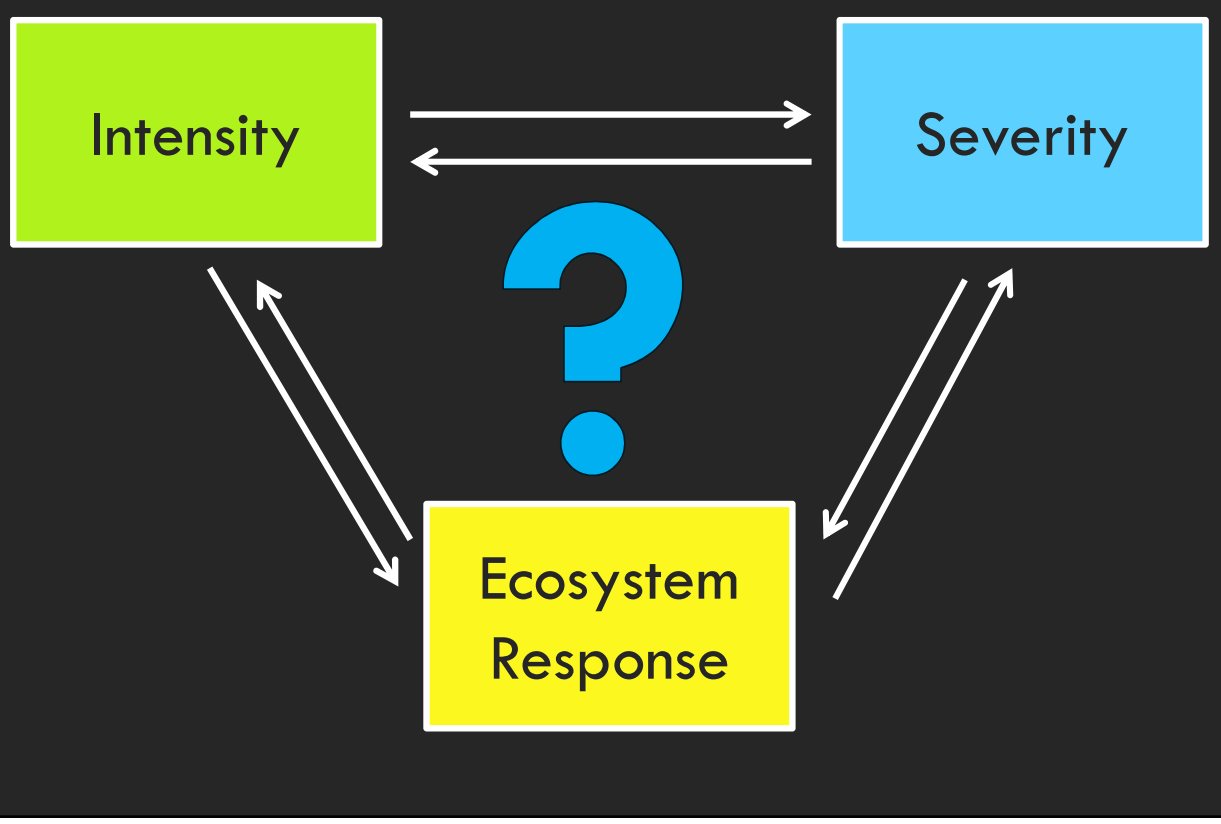
Spring 2011 & 2012

- Unusually warm and dry
- Peatland wildfires across the UK
- High severity including peat fires

Background

- A single fire occurs within in the context of a **Fire Regime**
- Fire behaviour can vary substantially within and between burns

Fires vary with regards to...




•Late-building phase heather (fuel height ≈ 30 cm)


•Mature heather (fuel height ≈ 45cm)

Objectives

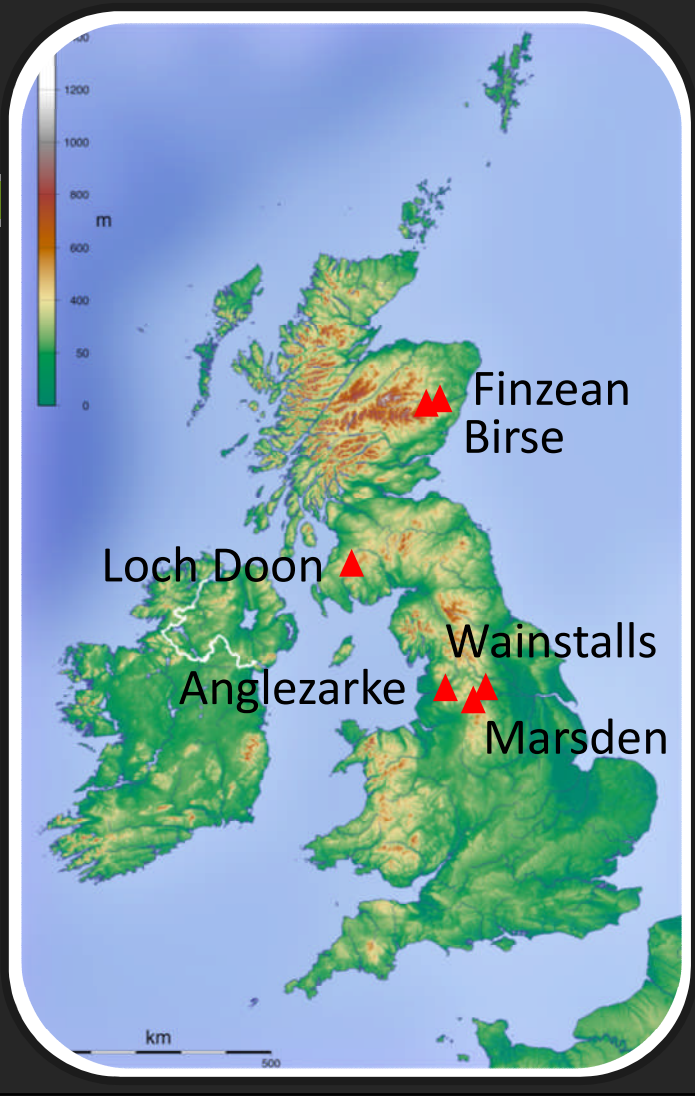
1. Develop method to describe the severity of peatland wildfires
2. Estimate carbon losses due to combustion
3. Determine fire effects on soil carbon fluxes (methane, carbon dioxide)
4. Quantify fire effects on biodiversity

Methods

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

1. Study sites

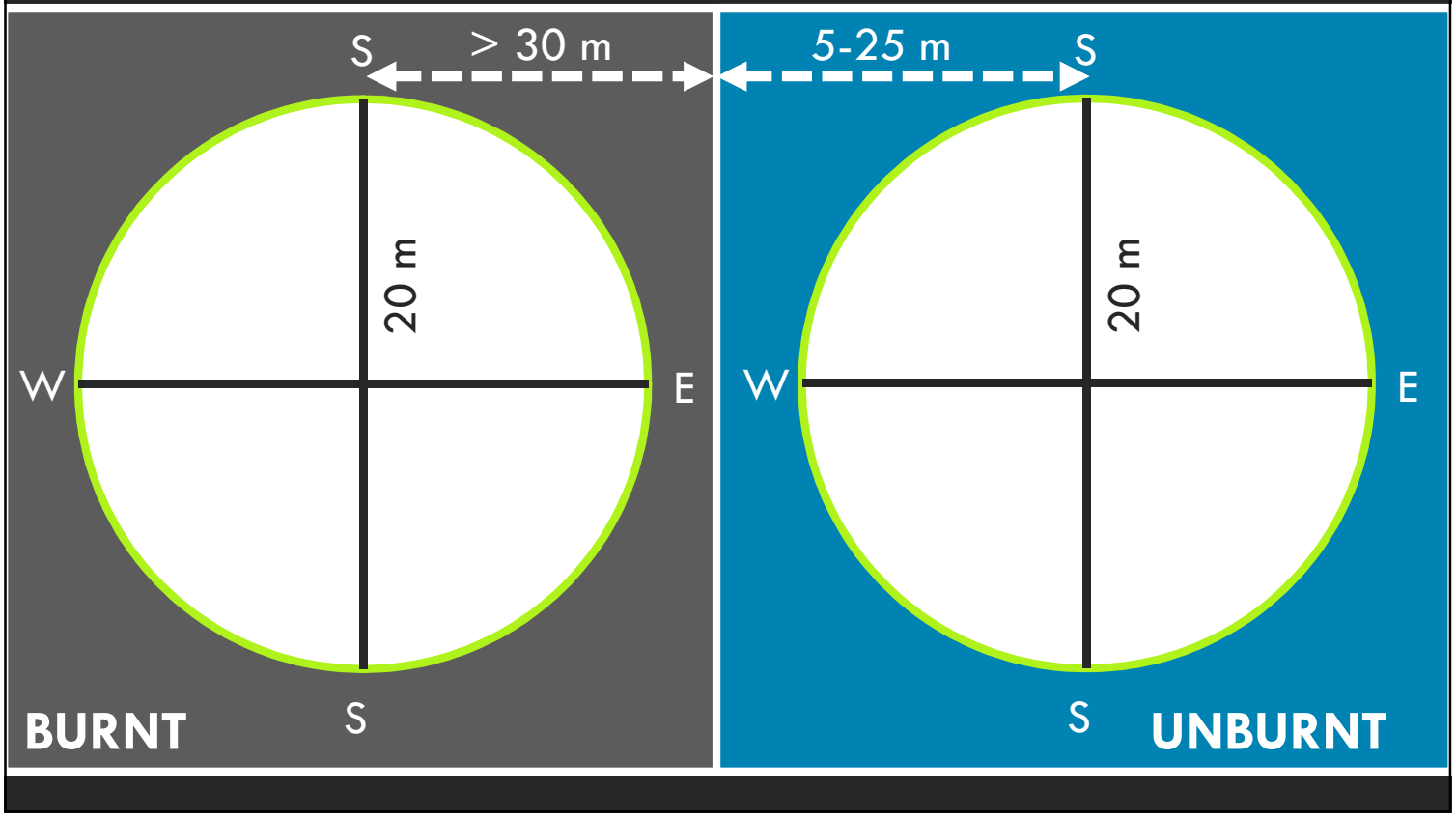
- 6 fires burnt in 2011/12 selected
- Fire perimeters mapped
- Initial "look-see" survey of variation in severity
- Record locations for further study



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:

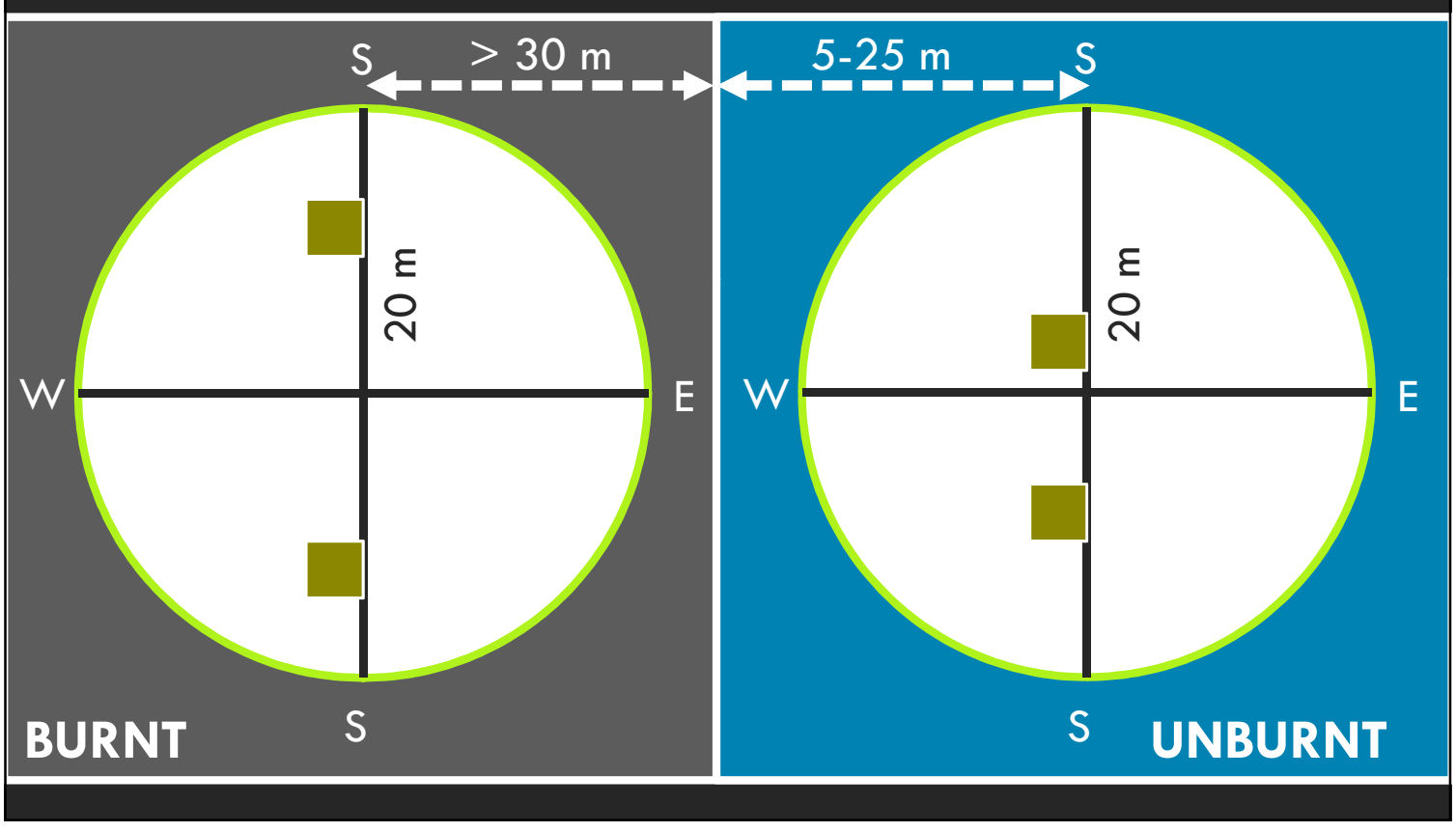
- Litter/light fuel consumed
- Peat consumed
- Exposed mineral soil
- *Sphagnum* damage
- Moss scorch/consumption
- *Sphagnum*/Moss survival

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



3. Fuel consumption

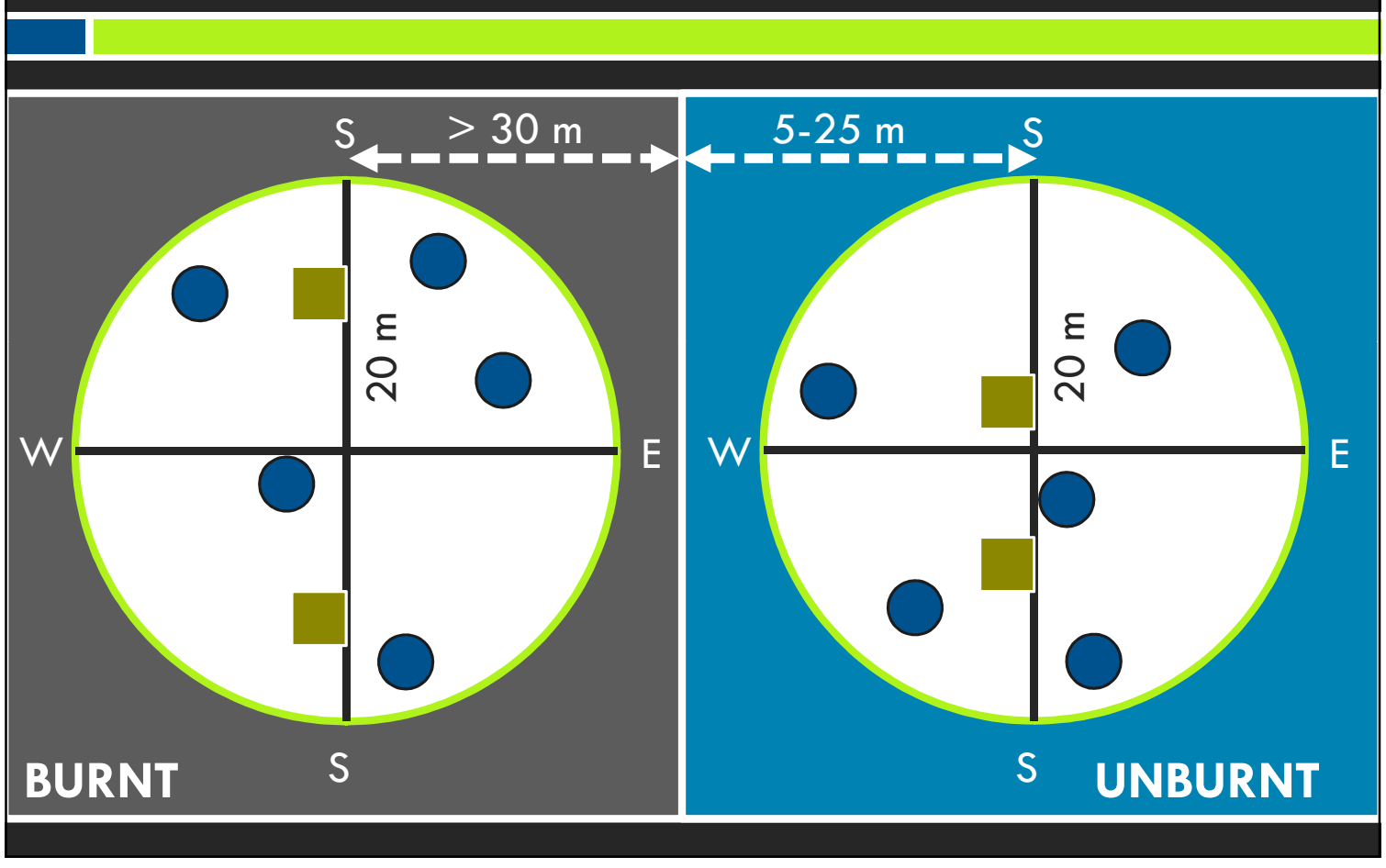
Harvested fuel sorted by:

- 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



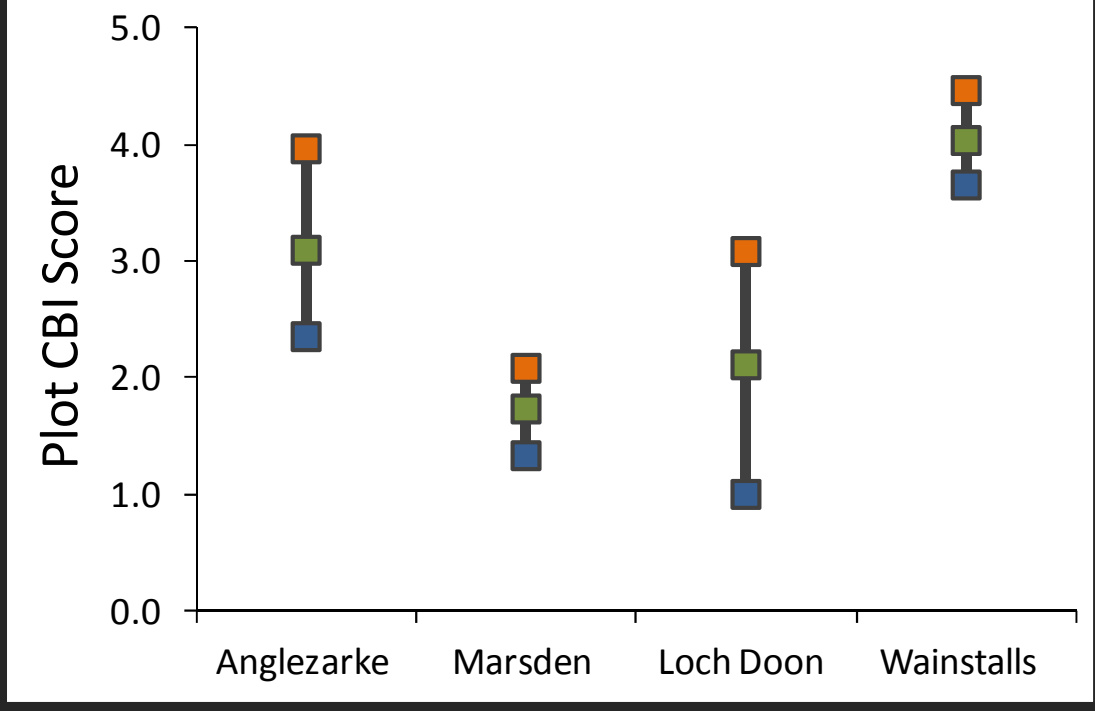
3. Recording soil gas fluxes

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

Results (so far)

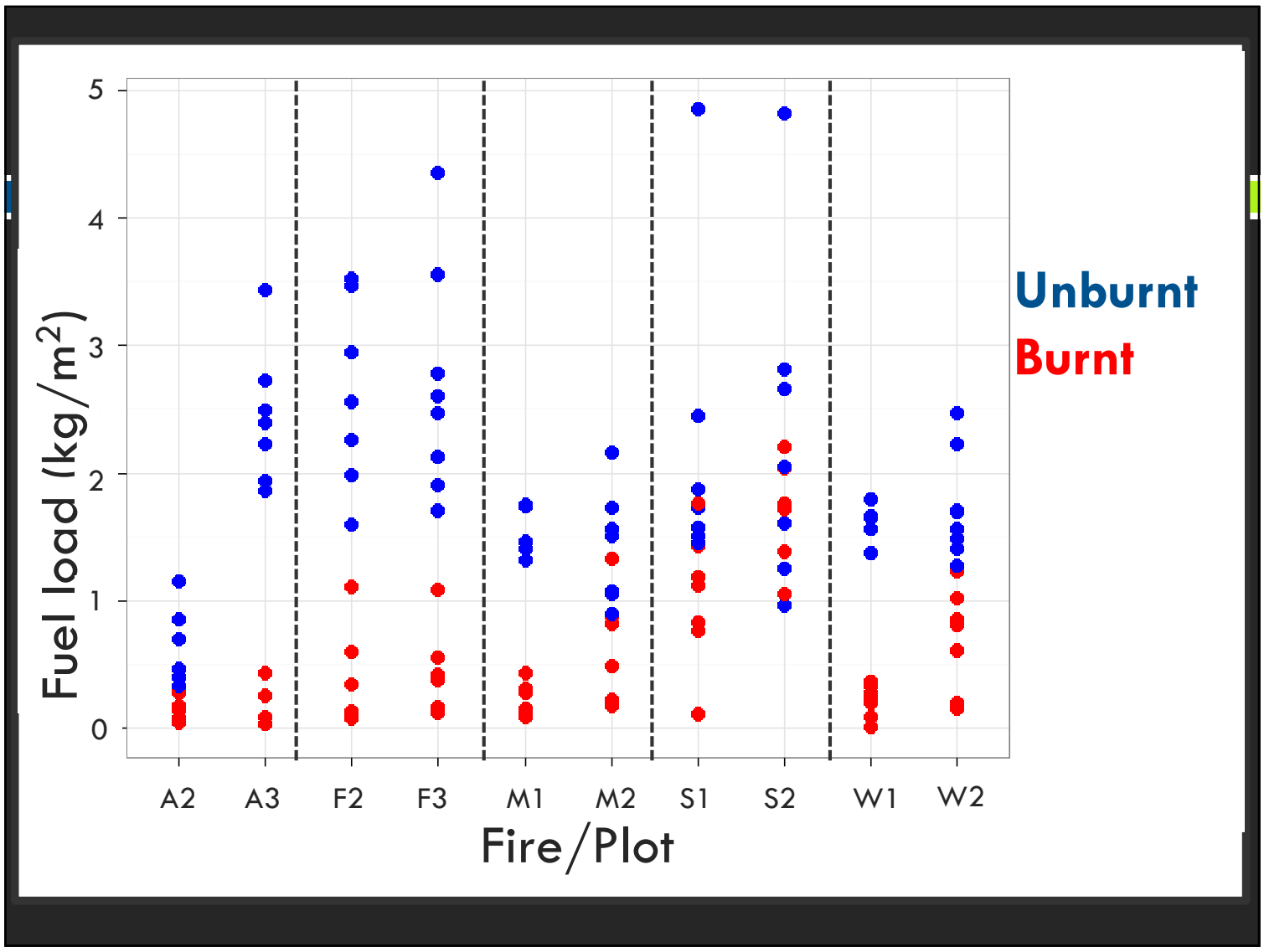
1. Fire severity
2. Fuel consumption
3. Soil carbon fluxes
4. Microclimatological effects

Variation in fire severity

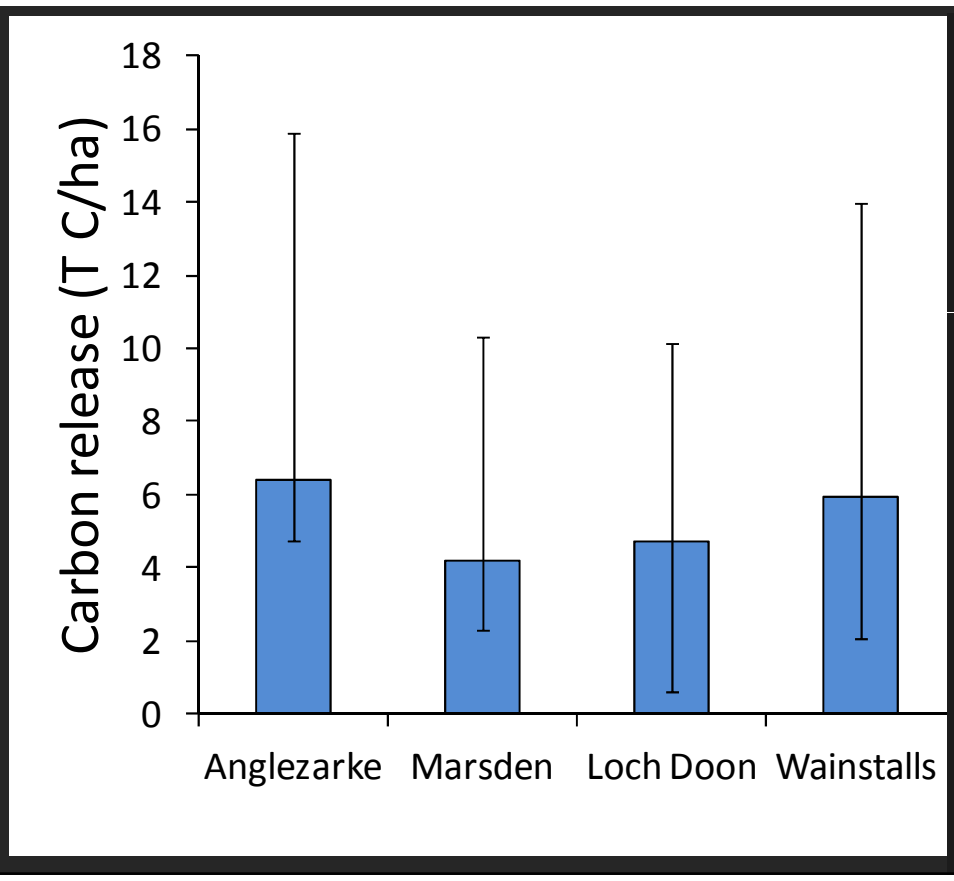


- Average CBI varied more than **two-fold between** fires
- CBI varied up to **three-fold within** fires

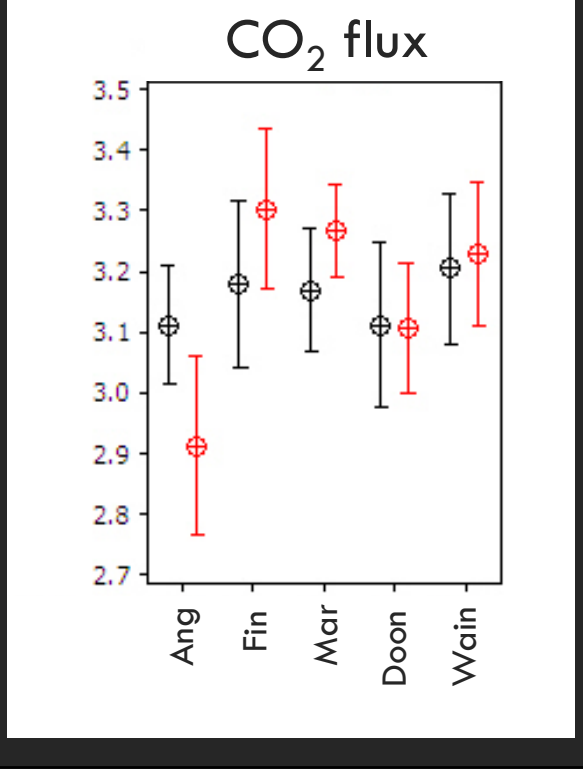
Fuel consumption



Fuel consumption



Soil carbon fluxes

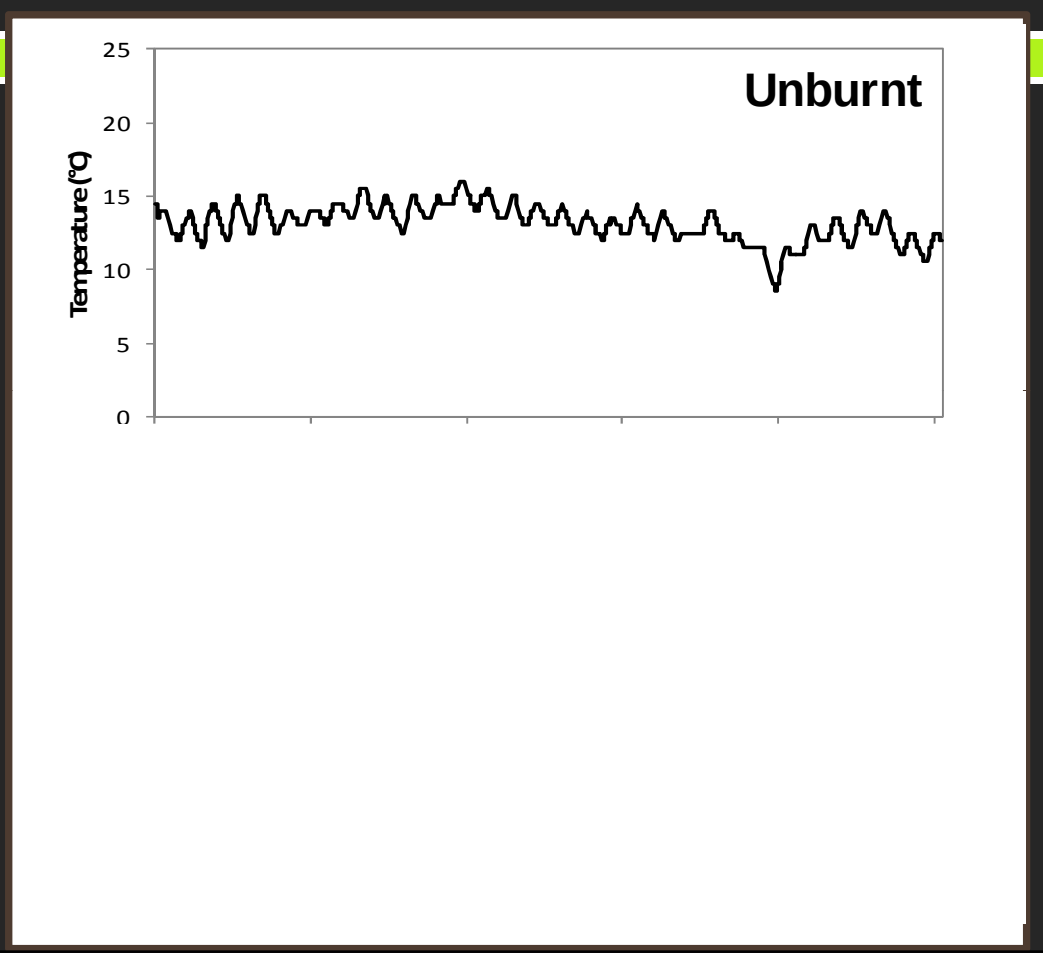


Burnt

Unburnt

Microclimatological 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

gwilym.davies@glasgow.ac.uk www.fireregimes.org.uk