Limited spatial co-occurrence of wildfires and muirburn across Scottish moorlands

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The James Hutton Institute

Muirburn

- Burning moorland vegetation for grazing and red grouse habitat
- Change from voluntary code to regulation - Wildfire Management and Muirburn (Scotland) Act 2024
- Question - does muirburn reduce wildfire risk by reducing fuel loads?

Muirburn and wildfire relationship

- Too limited evidence to draw conclusions

  Holland et al. 2022

- Muirburn causes a proportion of wildfires

  Glaves et al. 2020

- Muirburn reduces fuel load immediately following a fire. Also reduce structure and moisture content of heather that contribute to *fire intensity*

Holland, et al , 2022. Reviewing, assessing and critiquing the evidence base on the impacts of muirburn on wildfire prevention, carbon storage and biodiversity. Research Report; No. 1302. NatureScot

Glaves et al. 2020. The causes and prevention of wildfire on heathlands and peatlands in England (NEER014). Natural England: Peterborough, UK.

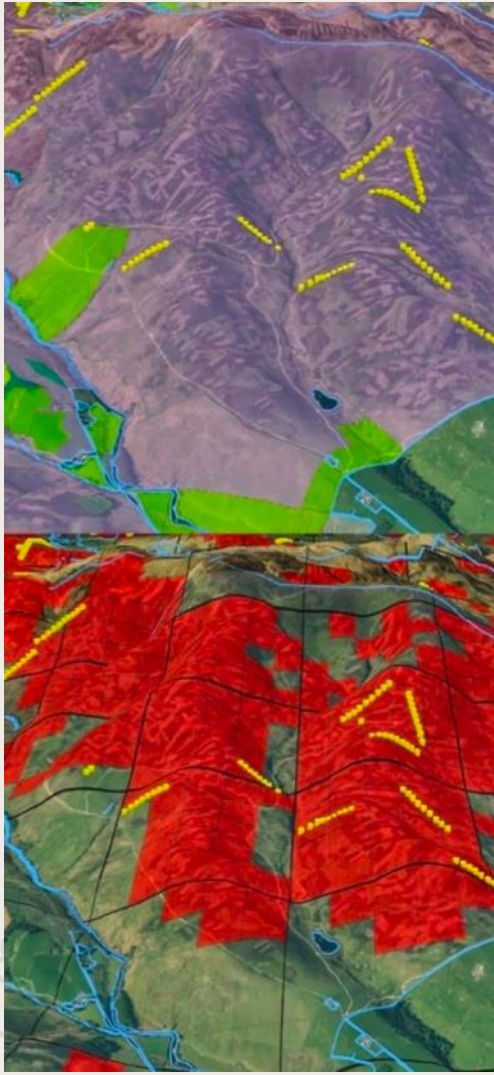
Spatial linkage muirburn and wildfire

Investigate potential spatial co-occurrence of muirburn and wildfires

Hypotheses:

(1) Wildfires are more frequent in muirburn areas as a result of escape fires

(2) Wildfires are less frequent in muirburn areas due to a reduction in fuel load



Detection of muirburn and wildfire

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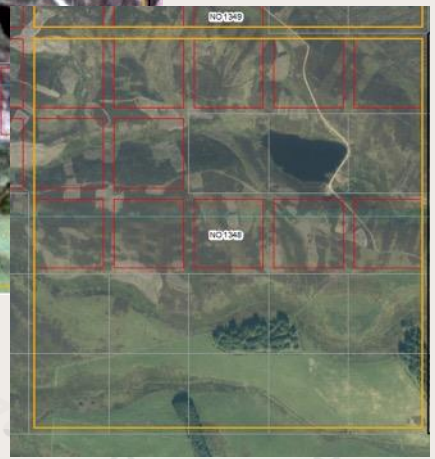
Muirburn 2018

Scars last several years

PlanetScope

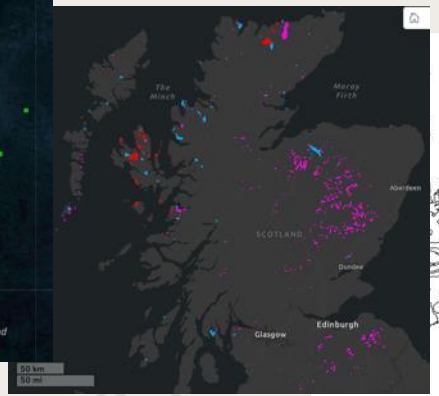
GetMapping



Wildfire 2015 - 2020

European Forest Fire Information System

NatureScot for Eastern Cairngorms Isle of Skye Sentinel-2



Scottish Fire and Rescue Service Incident Reporting System Sentinel-2

Muirburn intensity

1 km^2 cells subdivided 200 m x 200 m subarea cells

Subarea presence/absence of muirburn

Muirburn *intensity* categories:

- 0% i.e., no muirburn
- 1–20 %,
- 21–40 %
- 41–60 %
- 61–80 %
- 81–100 %

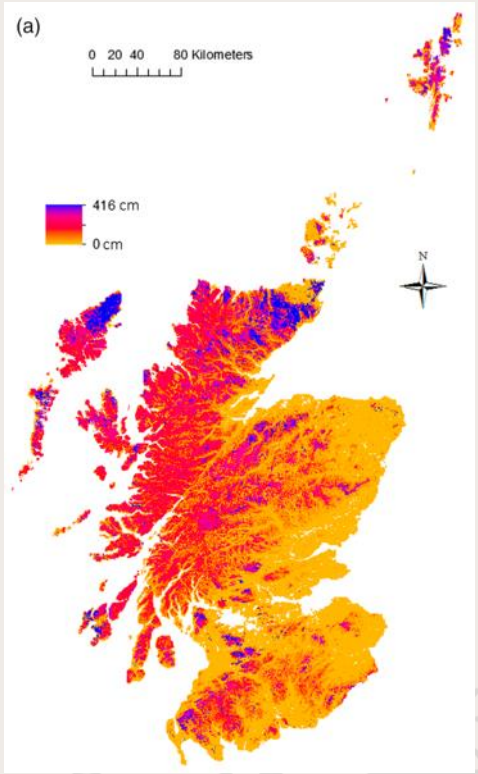
Dominant vegetation and peat soils

Moorland vegetation

- Acid grassland
- Heather grassland
- Heather heathlands
- Peatbogs

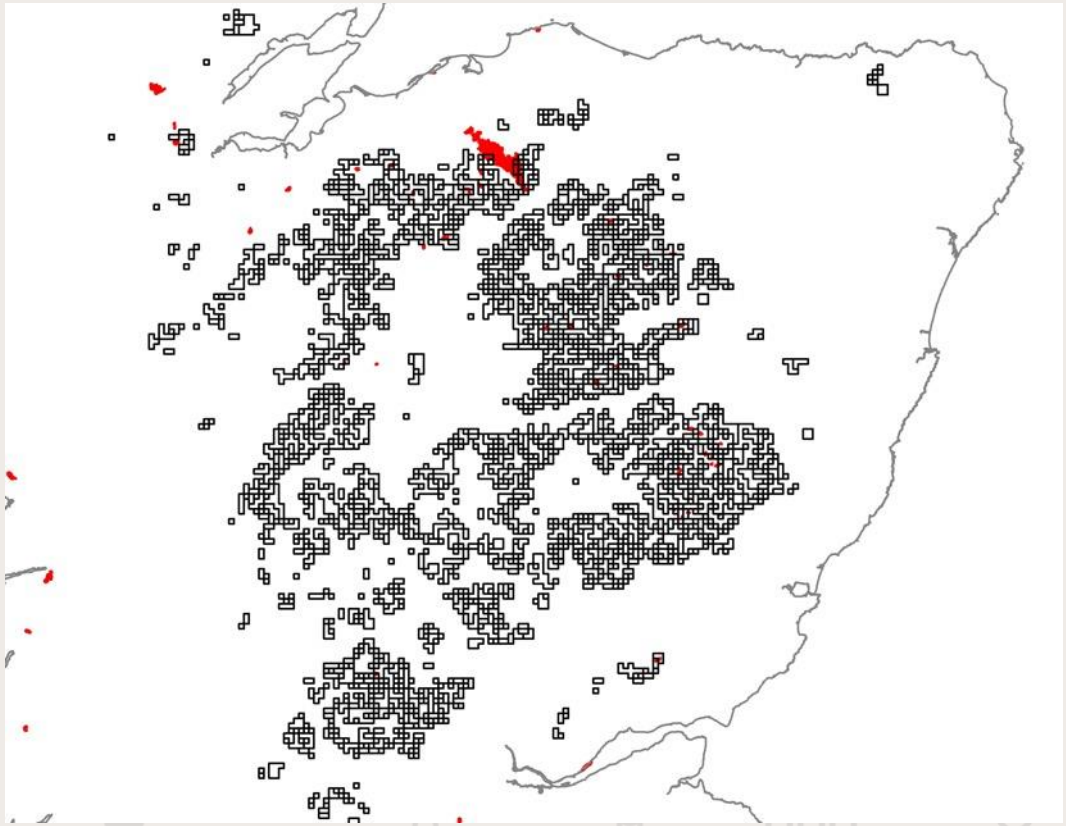
Morton et al. 2020. Land Cover Map 2018. NERC Dataset

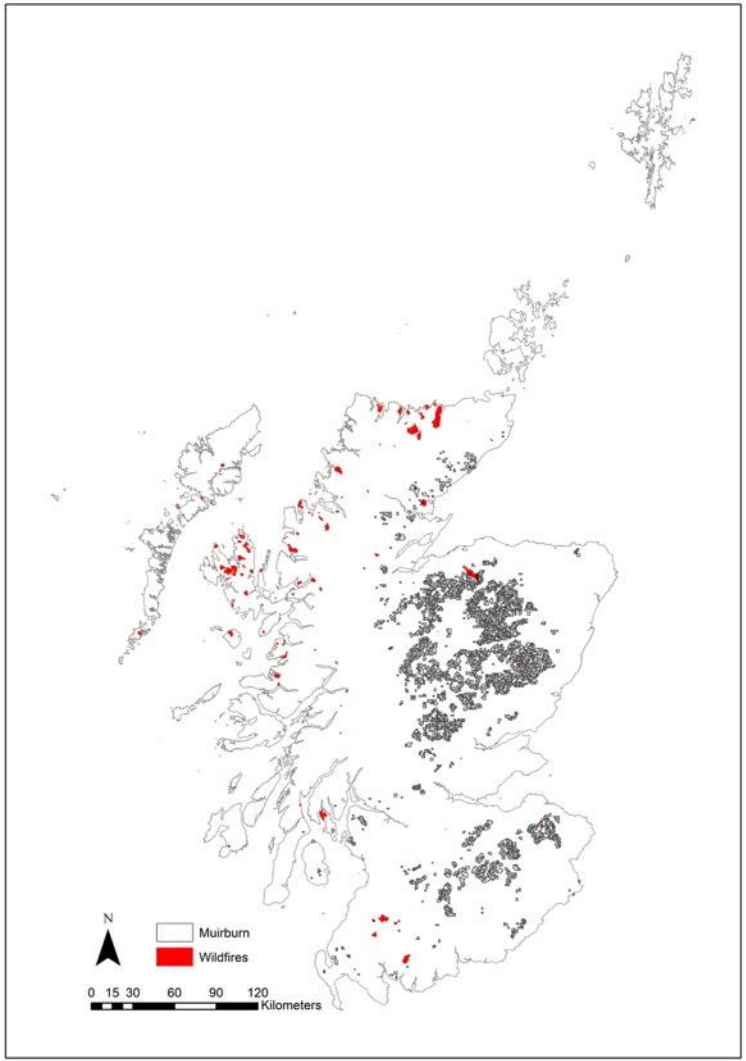
Peat thickness > 40 cm



Aitkenhead & Coull. 2020. Eur. J. Soil Sci. 71, 553–567

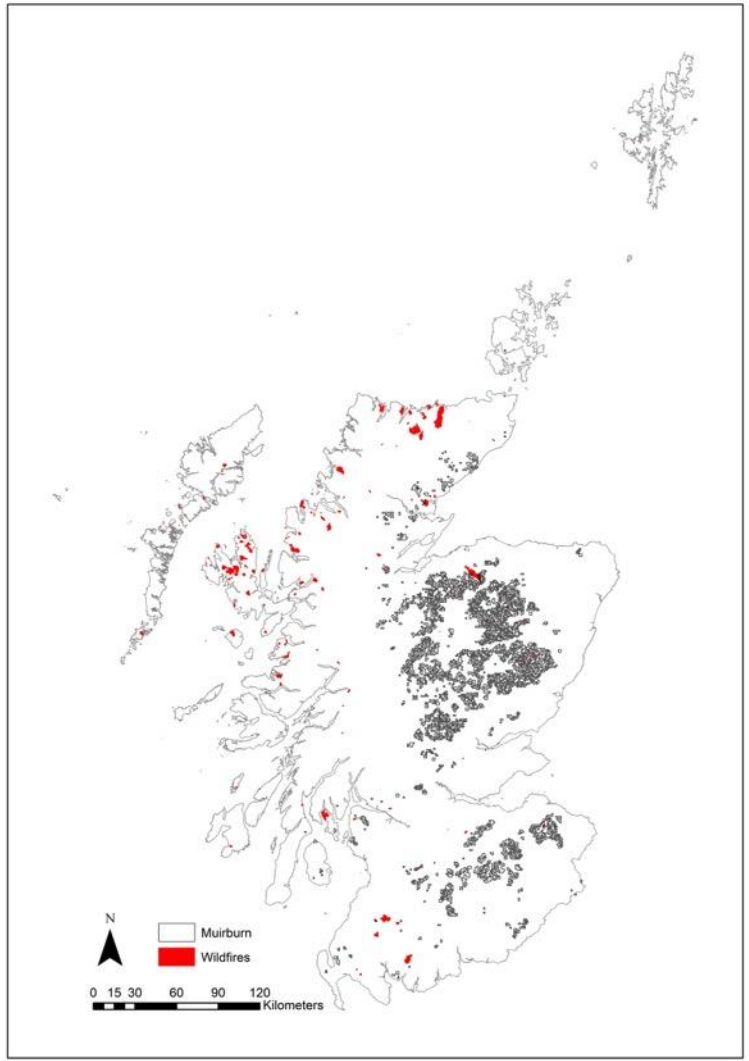
Muirburn Wildfire Intersect





Muirburn Wildfire Intersect

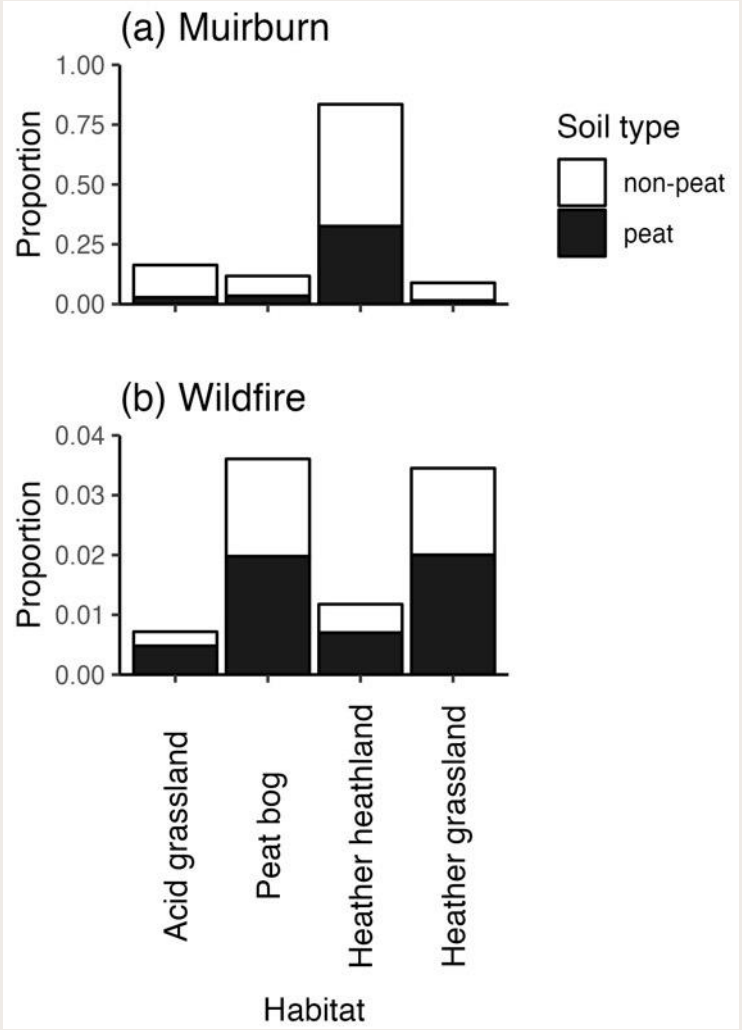
- Wildfire cover 1.1% (442 km^2) moorland area 2015 - 2020
- 96% wildfire area outside muirburn areas
- Only 0.4% of the muirburn area overlapped with wildfire area



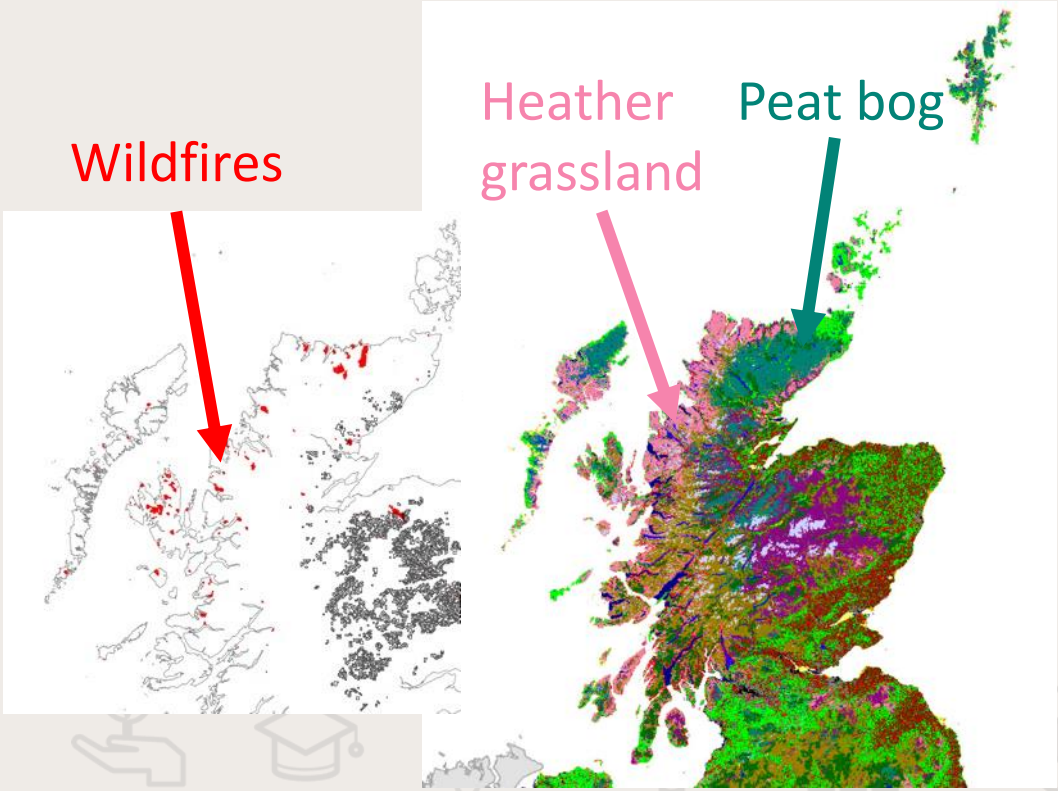
Muirburn vs wildfire occurrence varies by vegetation

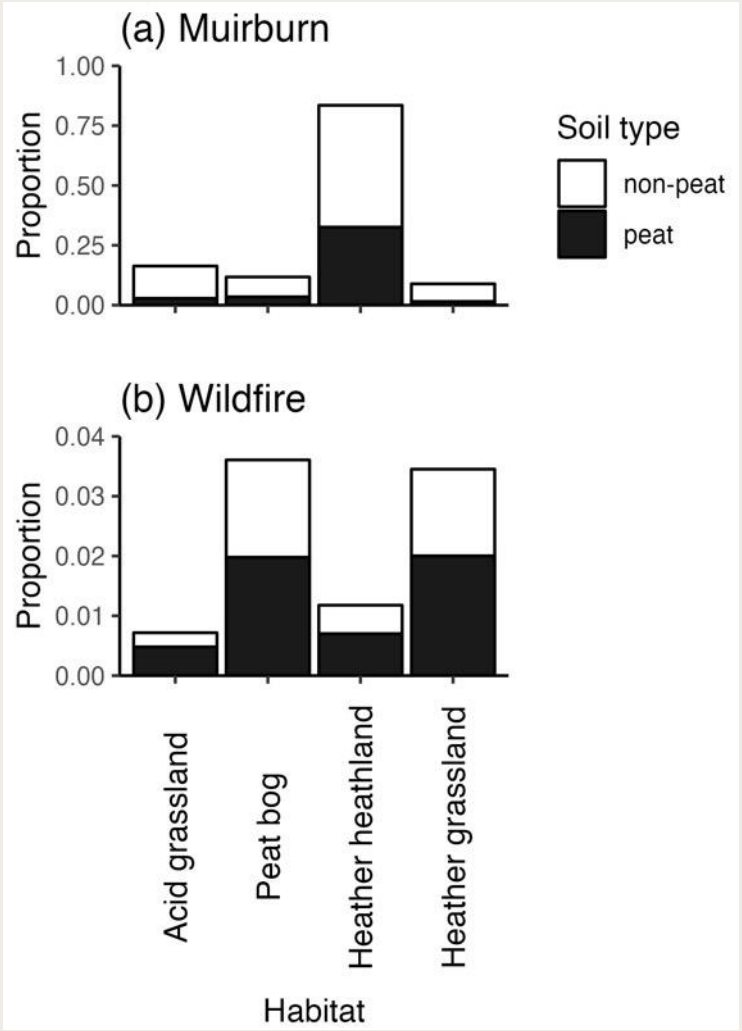
As a proportion of habitat area…

- More muirburn occurred on heather-dominated heathlands
- More wildfires occurred on peat bogs and heather grasslands (small absolute area)
- More wildfires on peat versus non-peat, not the case for muirburn

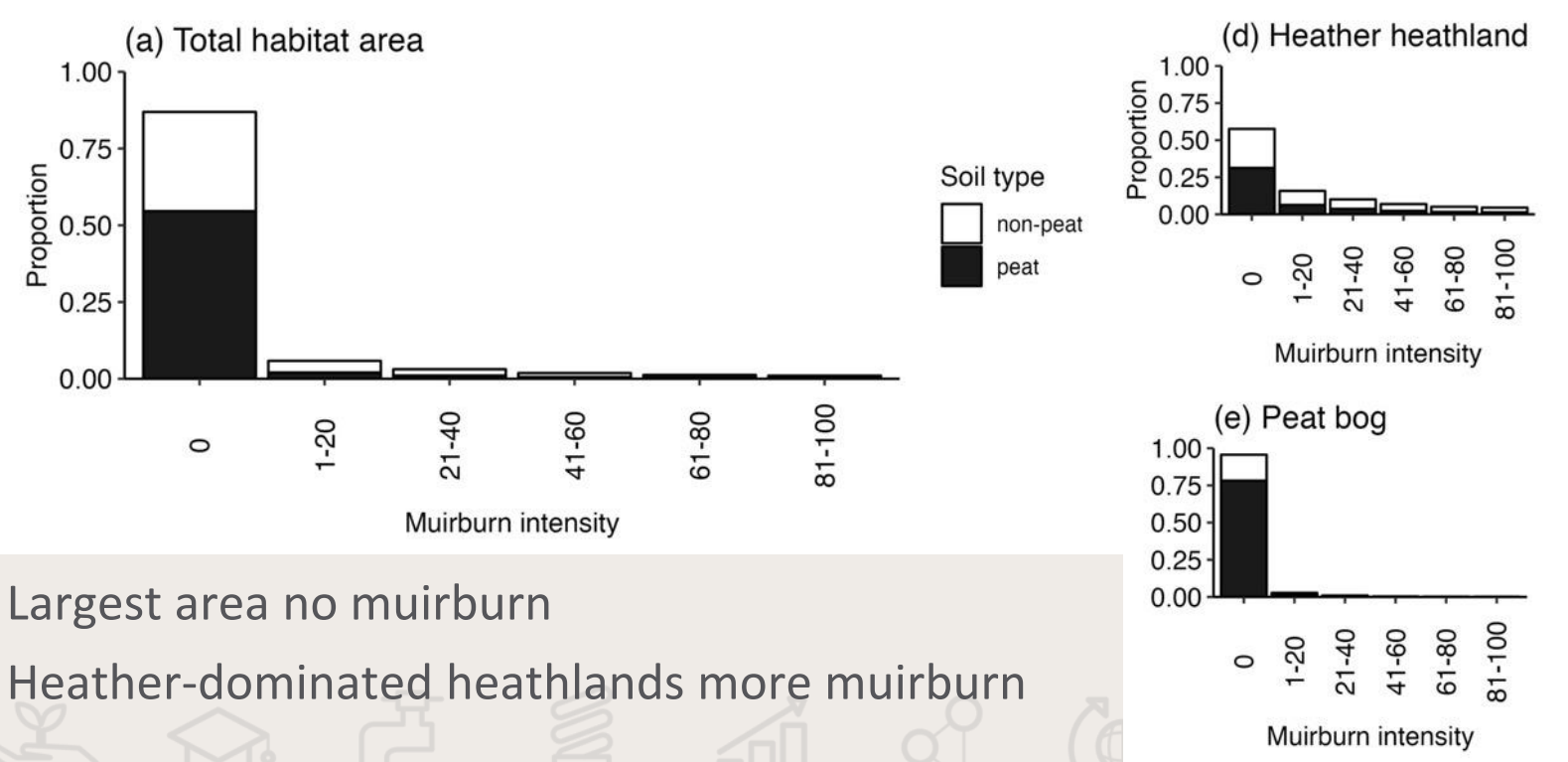


Muirburn vs wildfire occurrence varies by vegetation





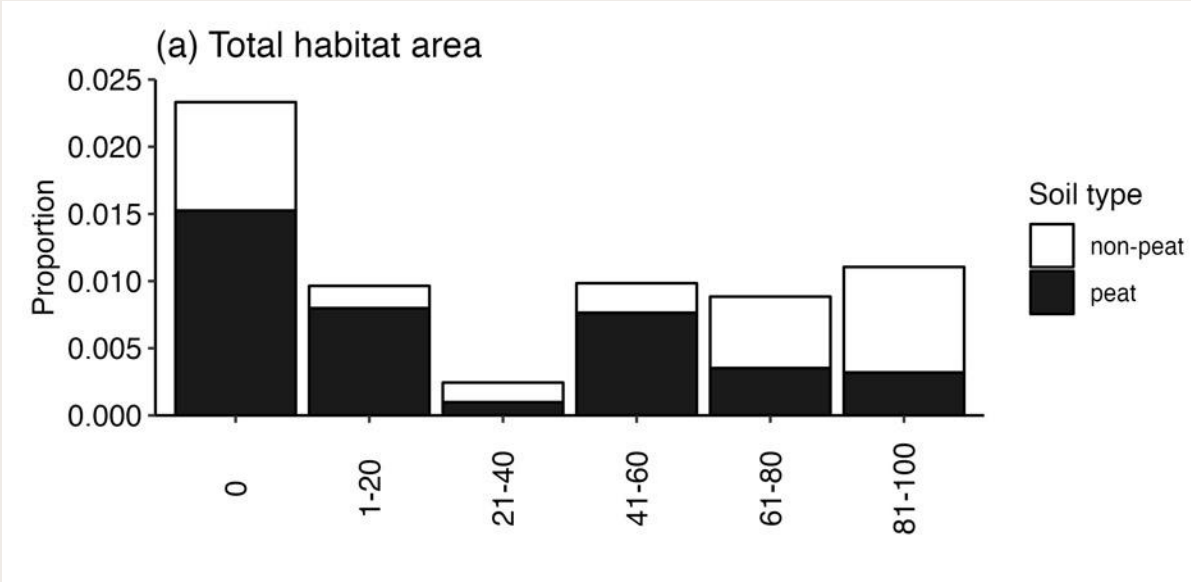
Muirburn intensity and vegetation

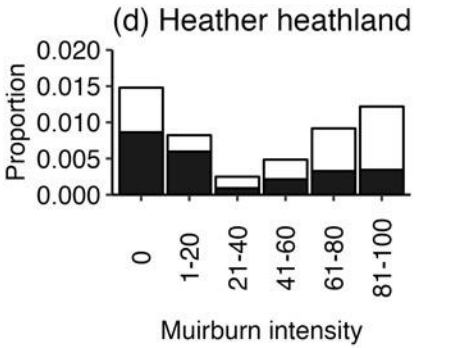


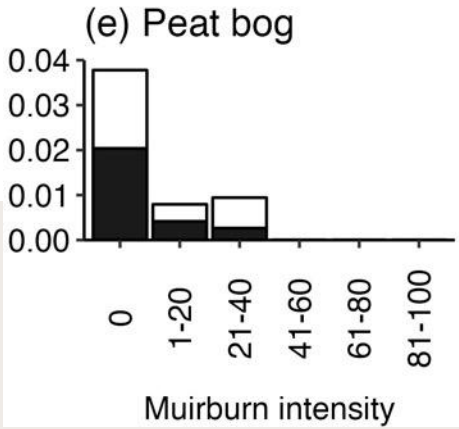
Largest area no muirburn

Heather-dominated heathlands more muirburn

Muirburn intensity and wildfire co-occur







Lower and higher muirburn intensities have highest proportion of wildfire – pattern matches heather heathlands

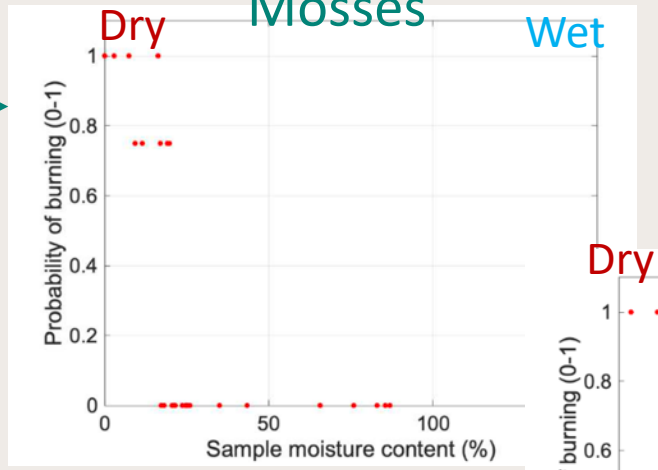
Muirburn and wildfire relationship?

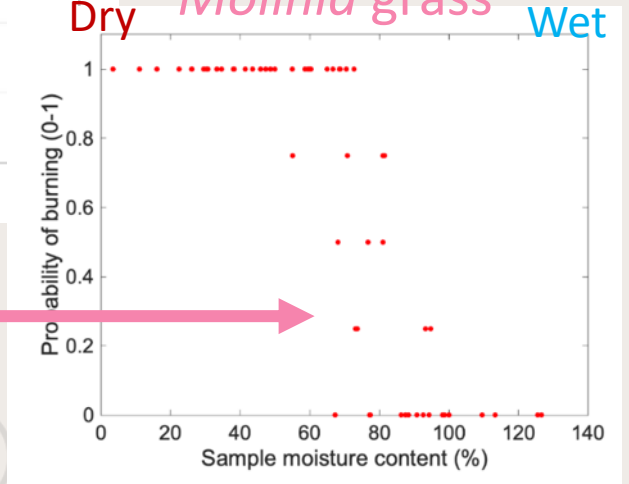
Low co-occurrence…. why?

- Muirburn reduces fuel loads, but not supported by muirburn intensity
- Estates using muirburn have fire prevention and response measures that reduce large wildfire outbreaks
- Muirburn landscapes low visitor numbers, fewer public ignition incidents i.e., camping stoves, cigarettes etc.

Need for research on vegetation fuel loads and flammability properties

- Rewetting potential to buffer peatlands
- Heather grasslands had equally high proportion of wildfires
- Grass *Molinia caerulea* (Purple Moor grass) – ignites at higher moisture content





Taylor et al. 2021. Fire Danger Rating System (FDRS) Report.

Impact on carbon budget: muirburn, cutting and wildfire?

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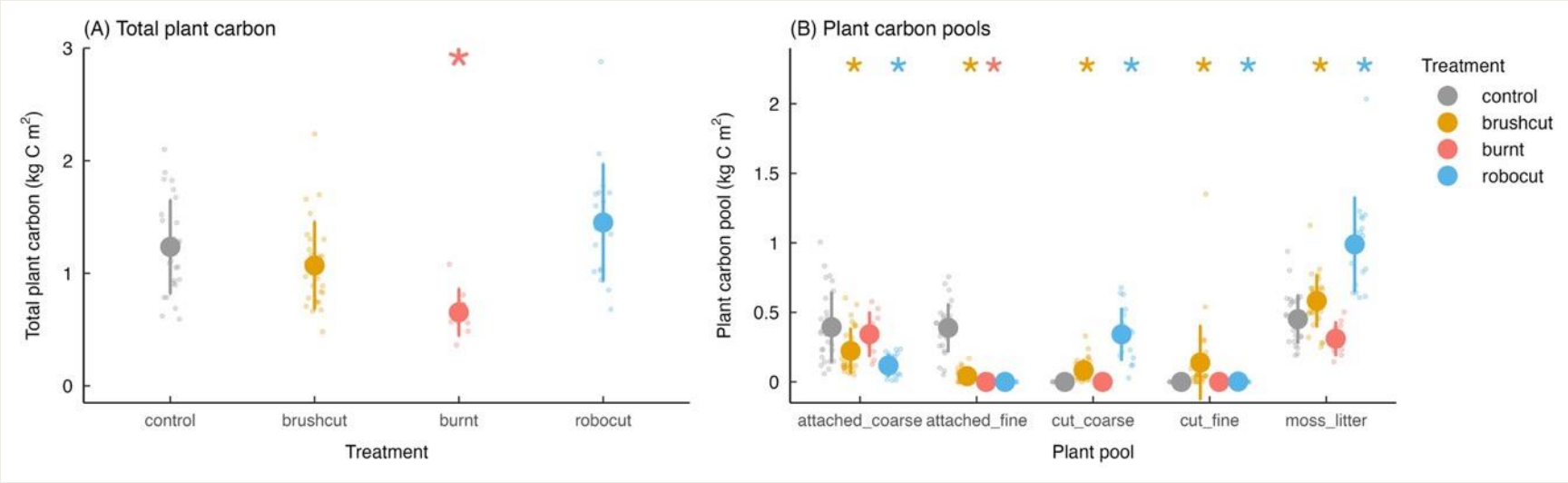

Muirburn 53% or 0.58 kg C m^{-2} immediate C loss and higher litter decomposition

Are cutting treatments with heather fragments more susceptible to wildfire?

Fielding et al. (in *prep*)

Acknowledgements

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