



Wildfire impacts on upland vegetation

Robin Pakeman & Noemi Naszarkowski



The James
Hutton
Institute

Wildfire and vegetation

- For this audience there is no need to justify the interest
- Two questions:
 - What affects fire severity?
 - What affects vegetation regeneration?



Upland vegetation



The James
Hutton
Institute

- Analysis restricted to three common vegetation types

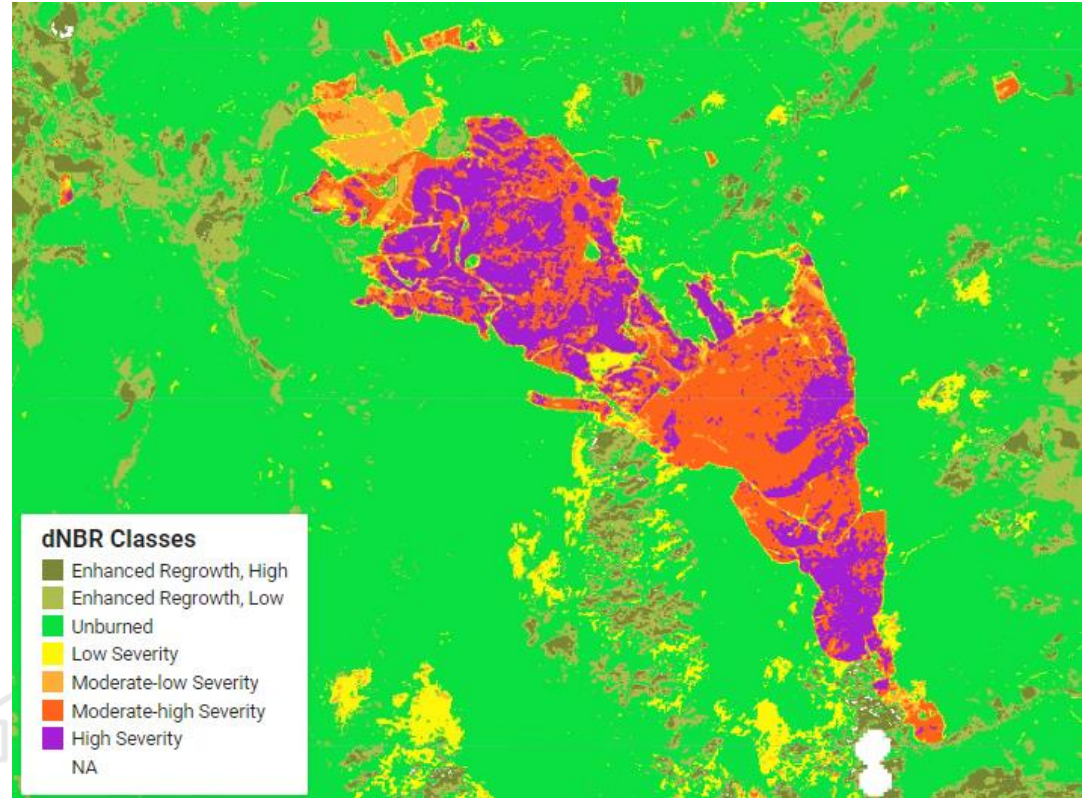


Q1. What affects fire severity?



The James
Hutton
Institute

- Fire severity = biomass consumed by fire
- Quantified by dNBR difference Normalised Burn Ratio
- 92 sites in the analysis (2015-2021)
- > 850,000 pixels



Q1. What affects fire severity?



The James
Hutton
Institute

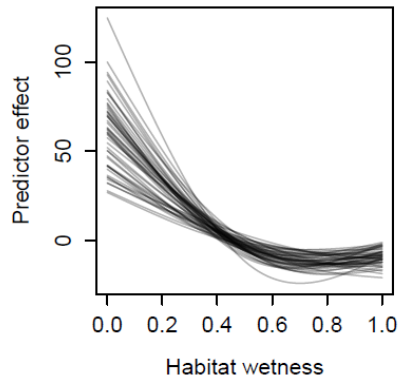
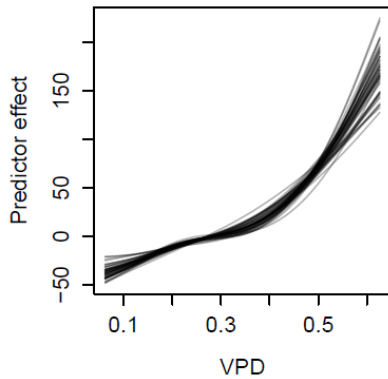
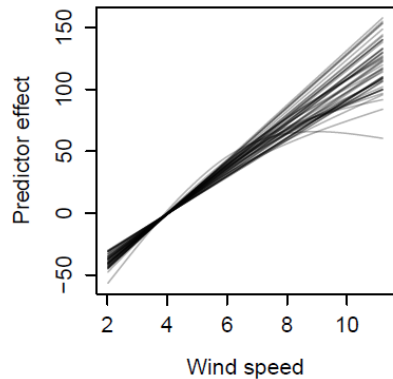
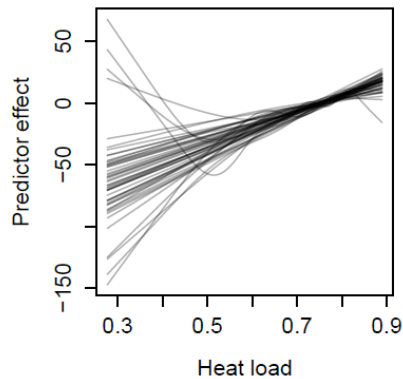
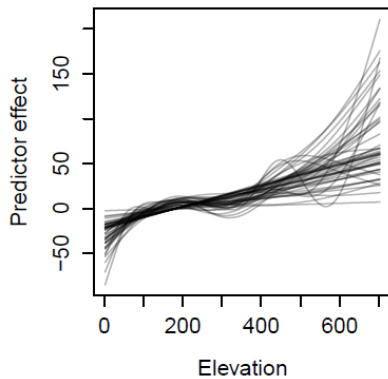
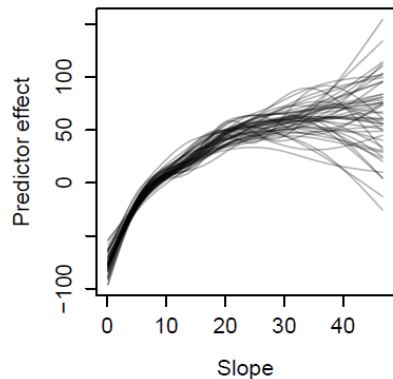
- Other factors:
 - Slope
 - Elevation
 - Heat load - combines aspect and slope
 - Wind speed
 - VPD - Vapour pressure deficit = index based on relative humidity and air temperature
 - Habitat wetness (0 = dry heath, 0.5 = wet heath, 1 = blanket bog)
 - Lagged temperature
 - Lagged rainfall



Q1. What affects fire severity?



The James
Hutton
Institute



- GAM outputs - 50 iterations of 50 random subsamples per site
- Together $R^2 = 0.25$



Q1. What affects fire severity?



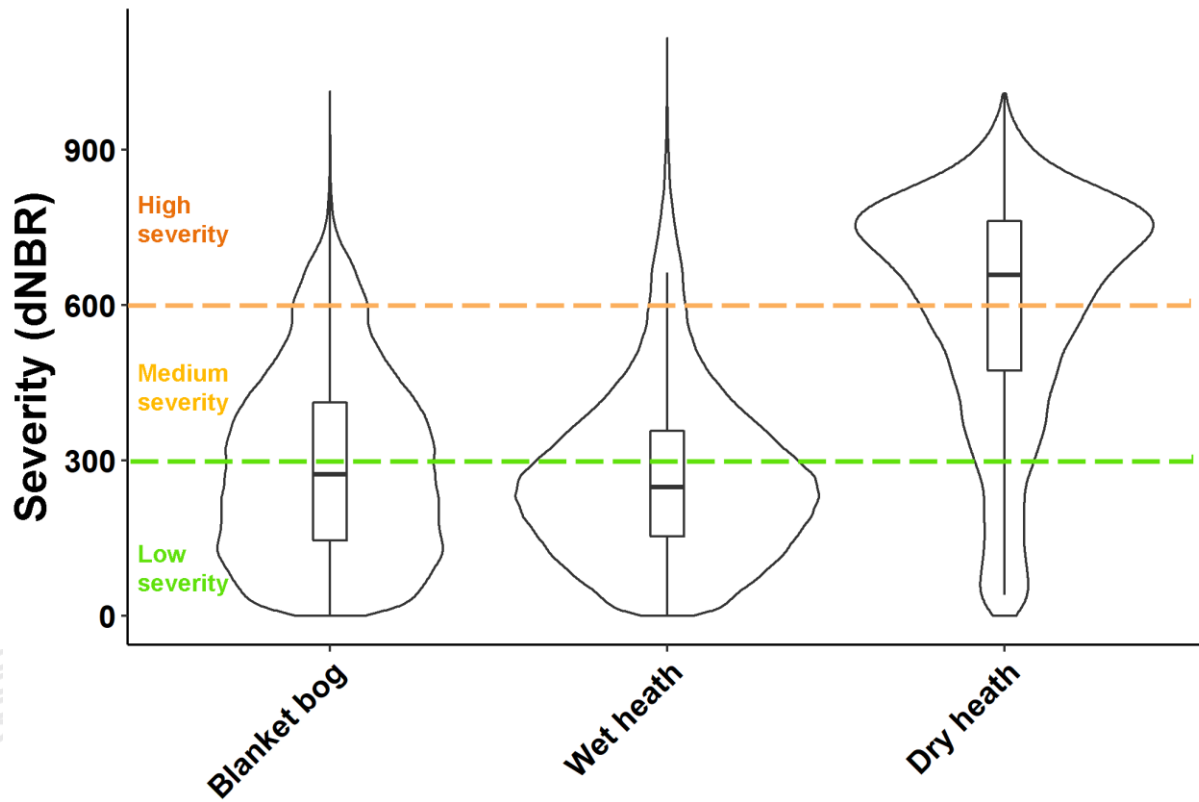
The James
Hutton
Institute

■ Habitat

Dry heath



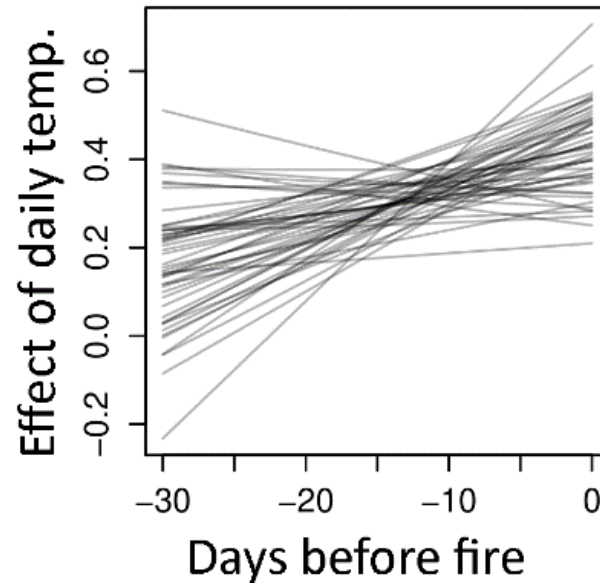
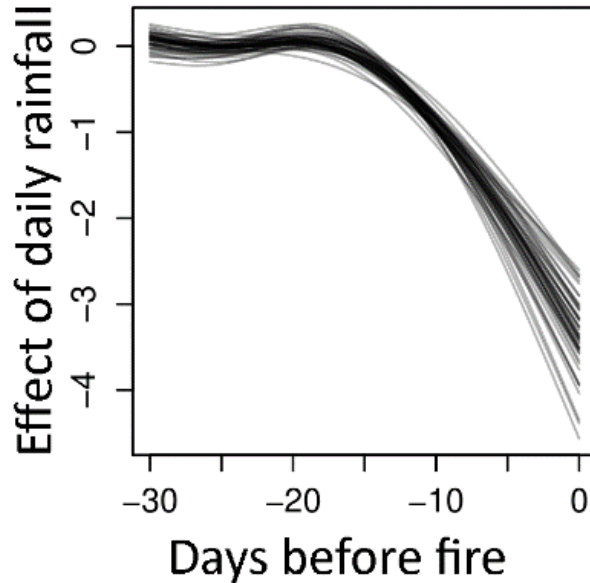
Wet heath/blanket bog



Q1. What affects fire severity?



The James
Hutton
Institute

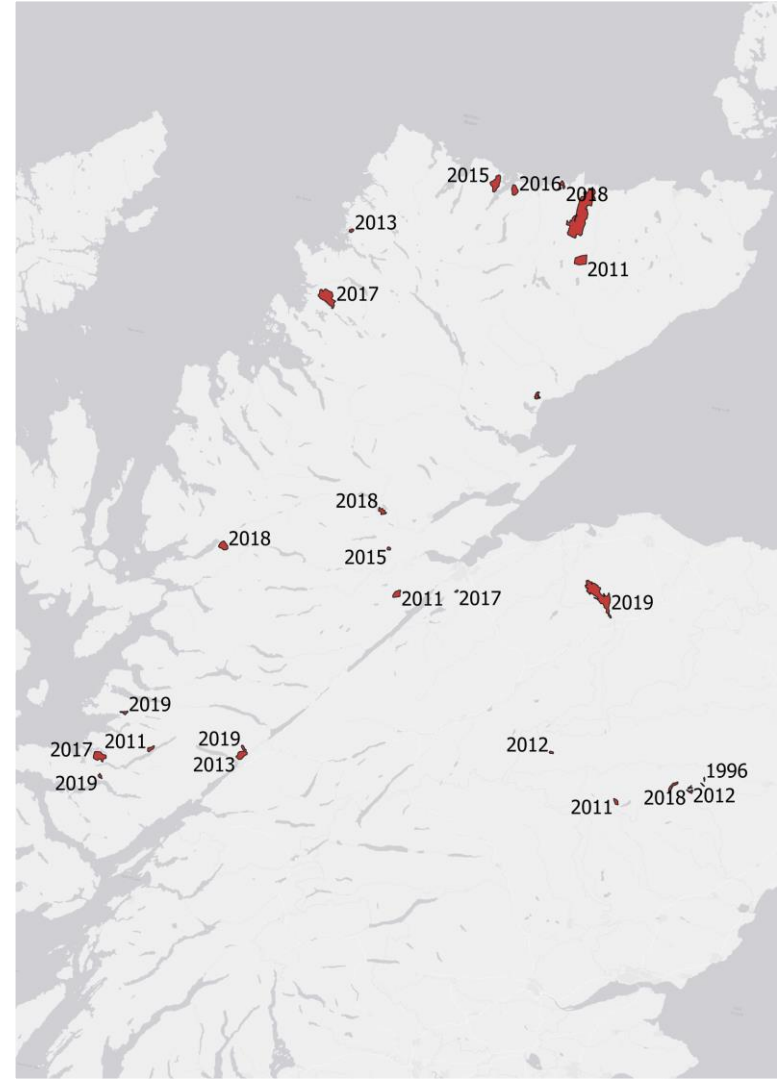


- More rainfall nearer the fire the less severe
- Warmer before the fire the more severe



Q2. What affects vegetation regeneration?

- Survey of 28 Scottish upland wildfire sites and adjacent unburnt areas
- 2 to 26 years since fire = different successional stages
- Fire severity (biomass consumption during fire) was assessed using remote sensing for sites covered by satellite data

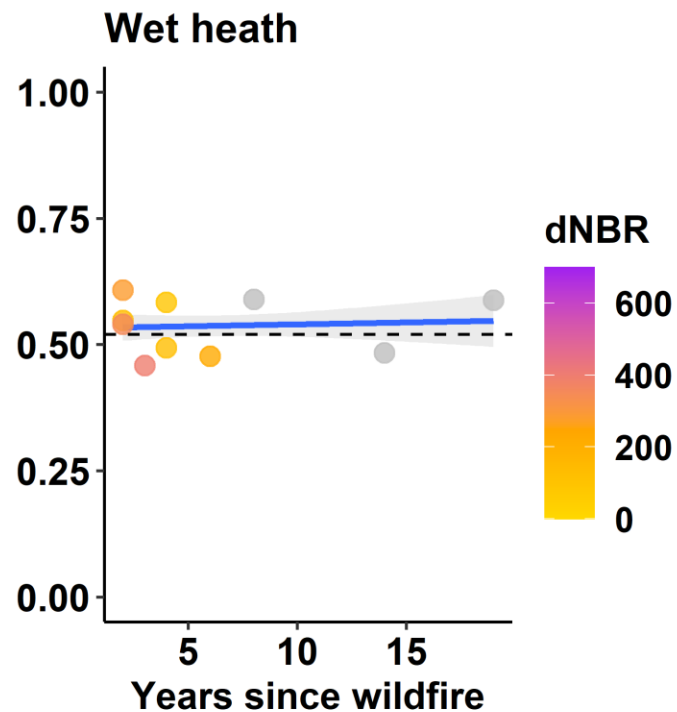
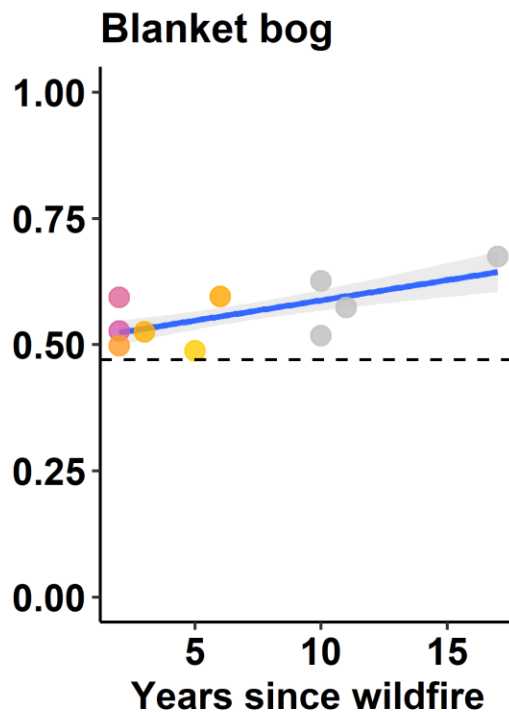
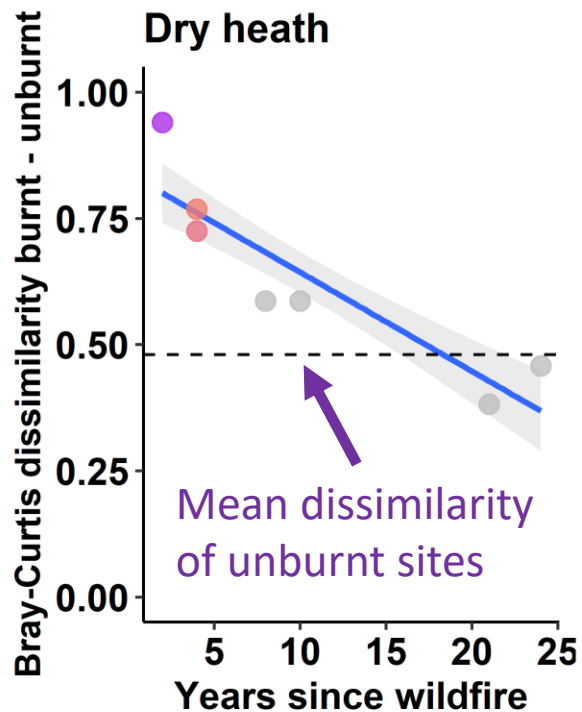


Q2. What affects vegetation regeneration?



The James
Hutton
Institute

■ Vegetation type

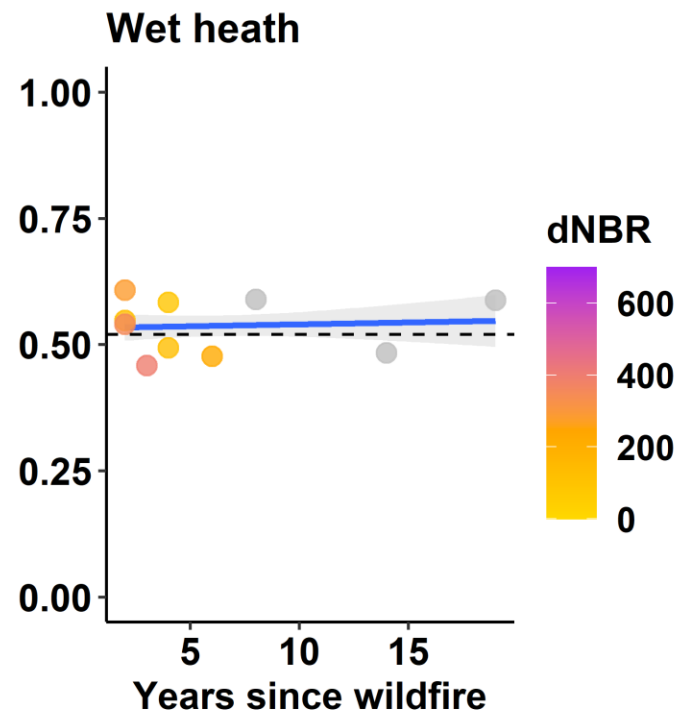
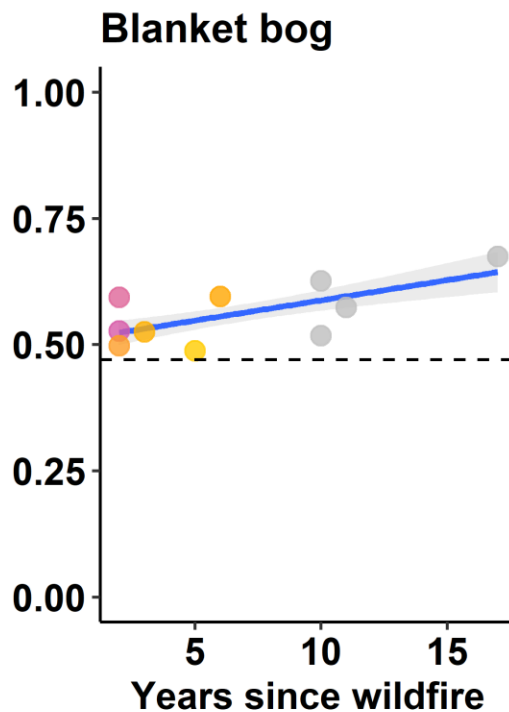
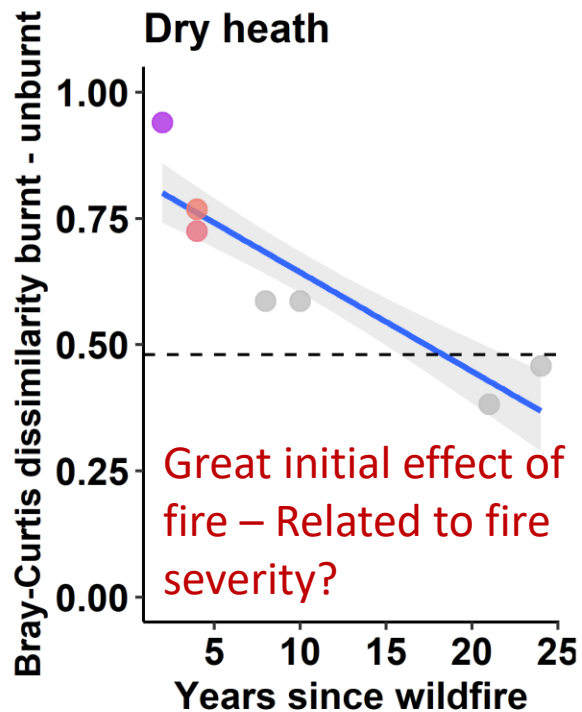


Q2. What affects vegetation regeneration?



The James
Hutton
Institute

■ Vegetation type

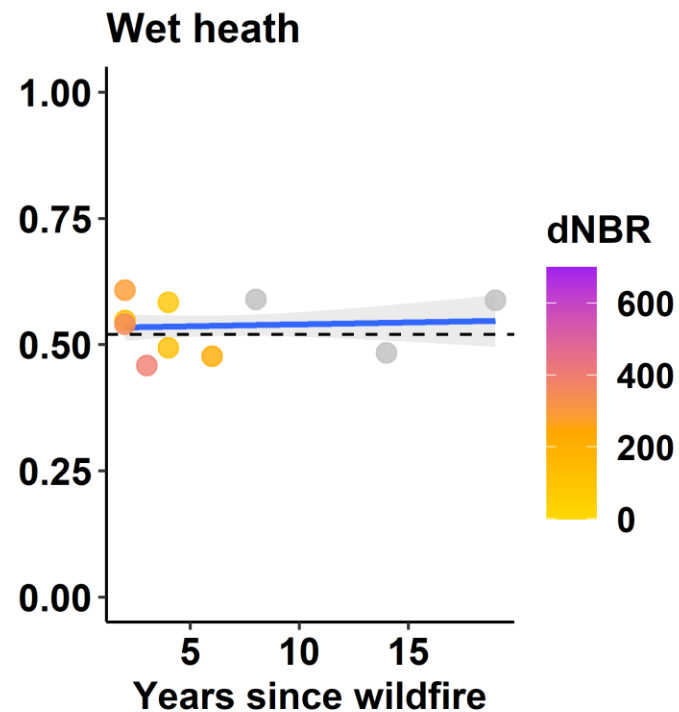
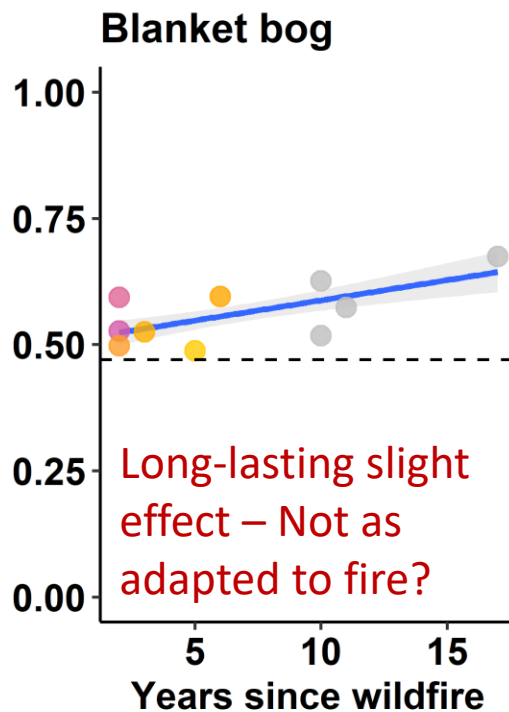
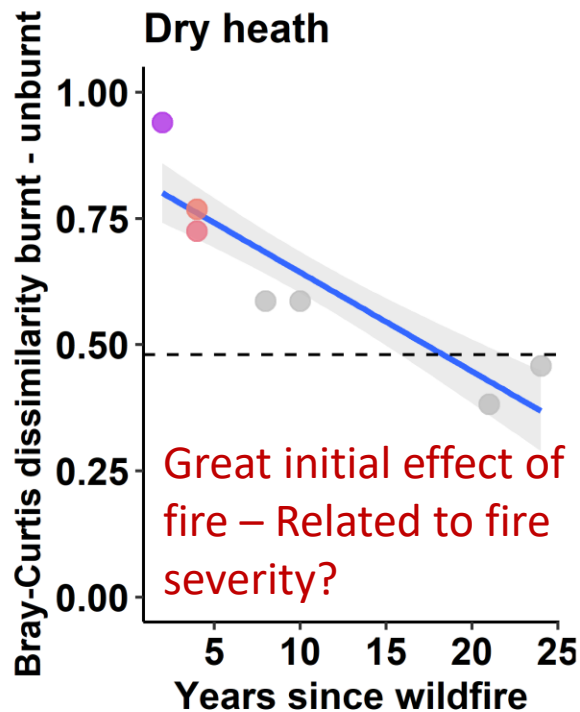


Q2. What affects vegetation regeneration?



The James
Hutton
Institute

■ Vegetation type

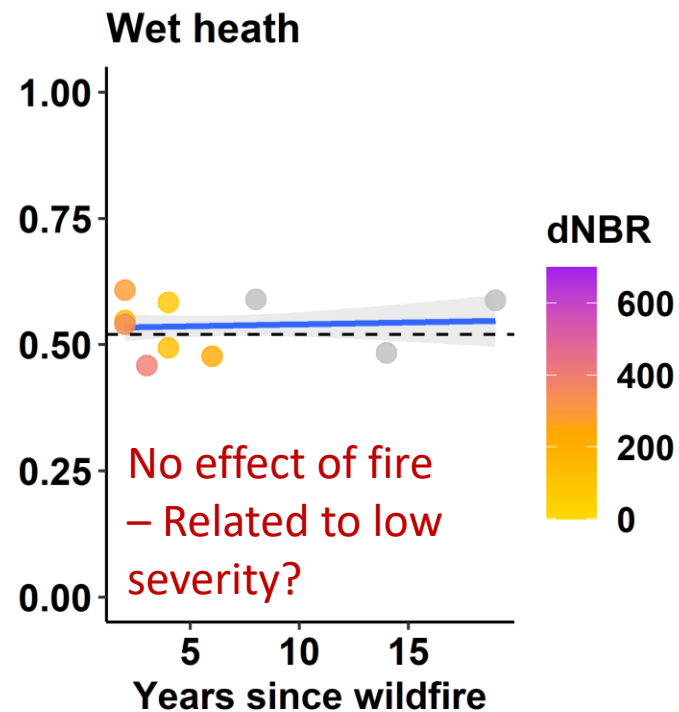
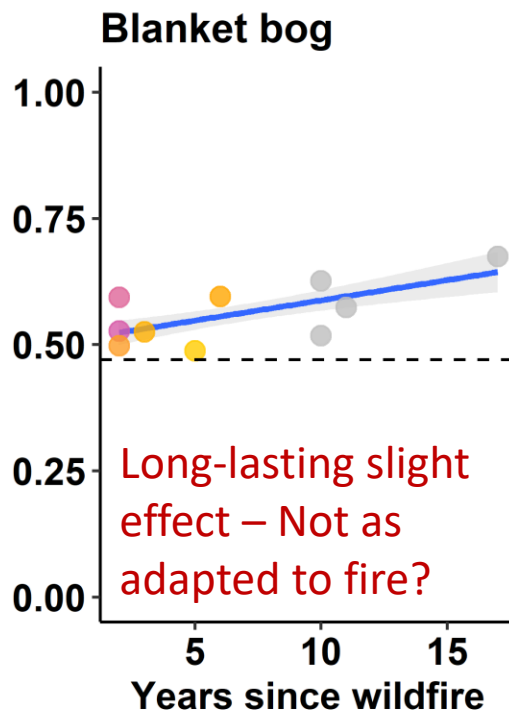
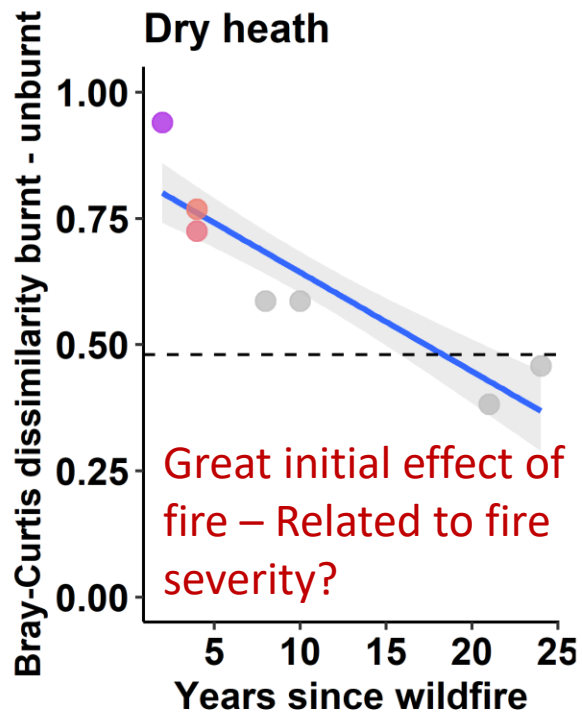


Q2. What affects vegetation regeneration?



The James
Hutton
Institute

■ Vegetation type



2 years after fire



Dry heath



Blanket bog



Wet heath

15-20 years after fire



Dry heath



Blanket bog



Wet heath



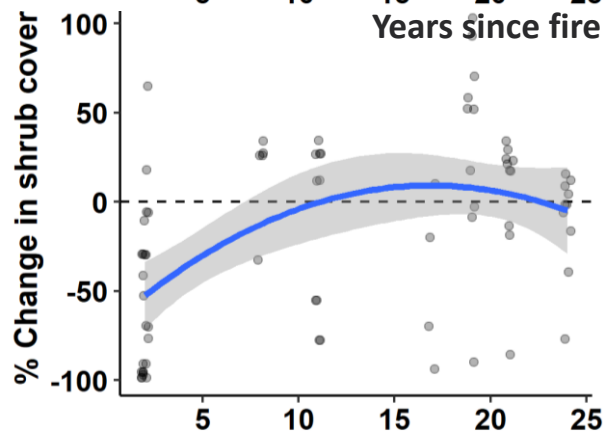
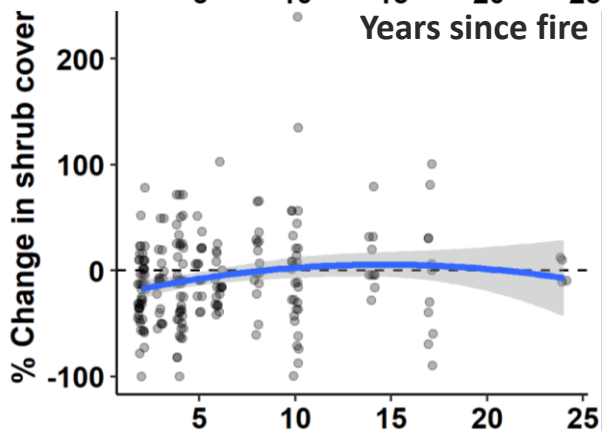
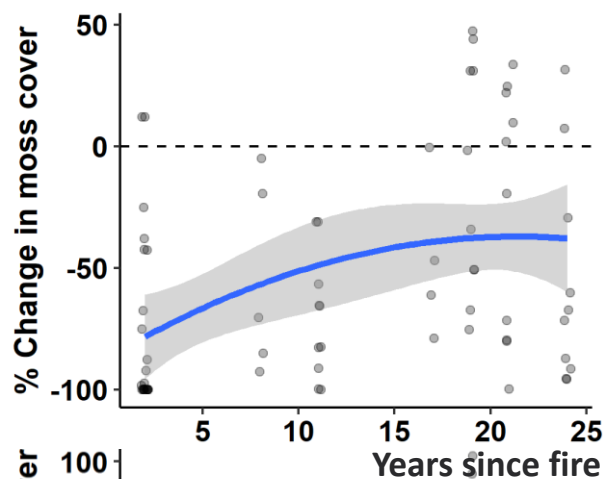
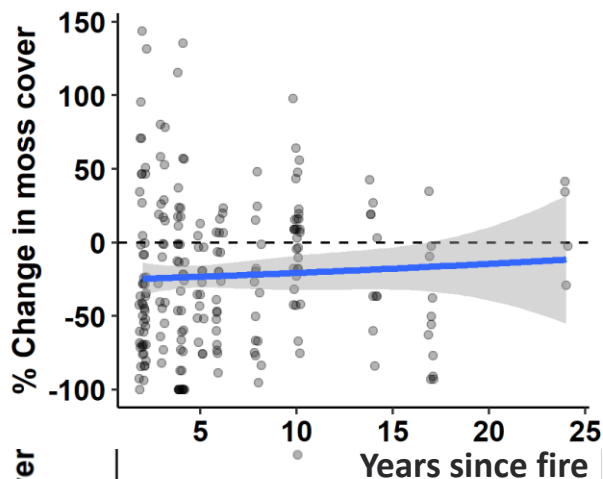
Q2. What affects vegetation regeneration?



The James
Hutton
Institute

Elevation < 400 m

Elevation > 400 m



- Moss and shrub cover more affected by wildfire at high altitudes



Main findings



The James
Hutton
Institute

- Wildfire severity in moorlands is affected by small- and large-scale factors:
 - Positive effect of slope, negative effect of habitat wetness
 - Positive effect of wind and vapour pressure deficit
 - Negative effect of recent rain, positive effect of recent temperature
- Dry heath experiences highest fire severity and greatest initial effect on vegetation composition. Wet heath most resistant and/or resilient.
- Recovery may be slower at high altitudes. Slow regeneration of moss cover may result in increased bare ground for a long time at high altitude.



Limitations



The James
Hutton
Institute

- More sites always nice
- No sites where fire had burnt into the peat – big question as to when and where this might occur. Also, recovery can be very slow.



Addendum 1



The James
Hutton
Institute

- Presentation about vegetation
- What about animals?
- Dispersal of one plant bug into intact turf

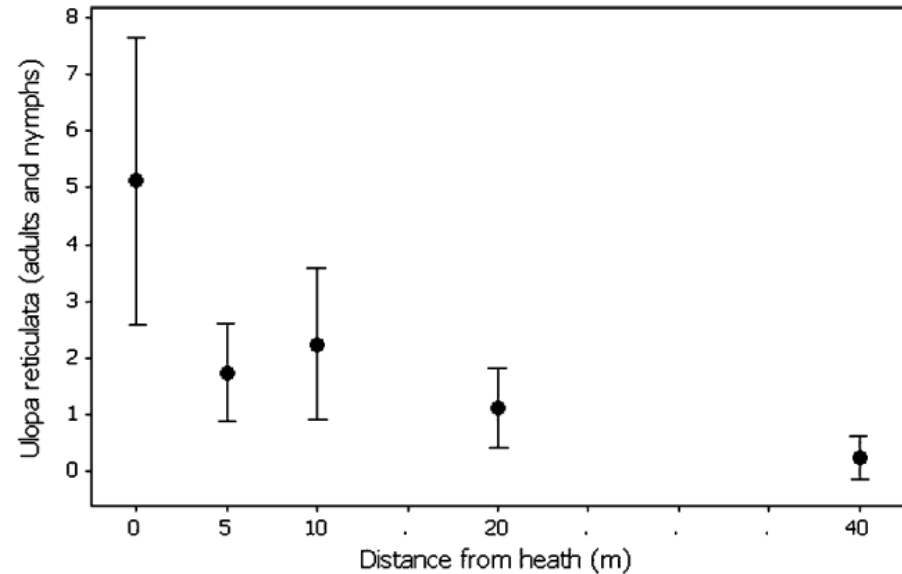


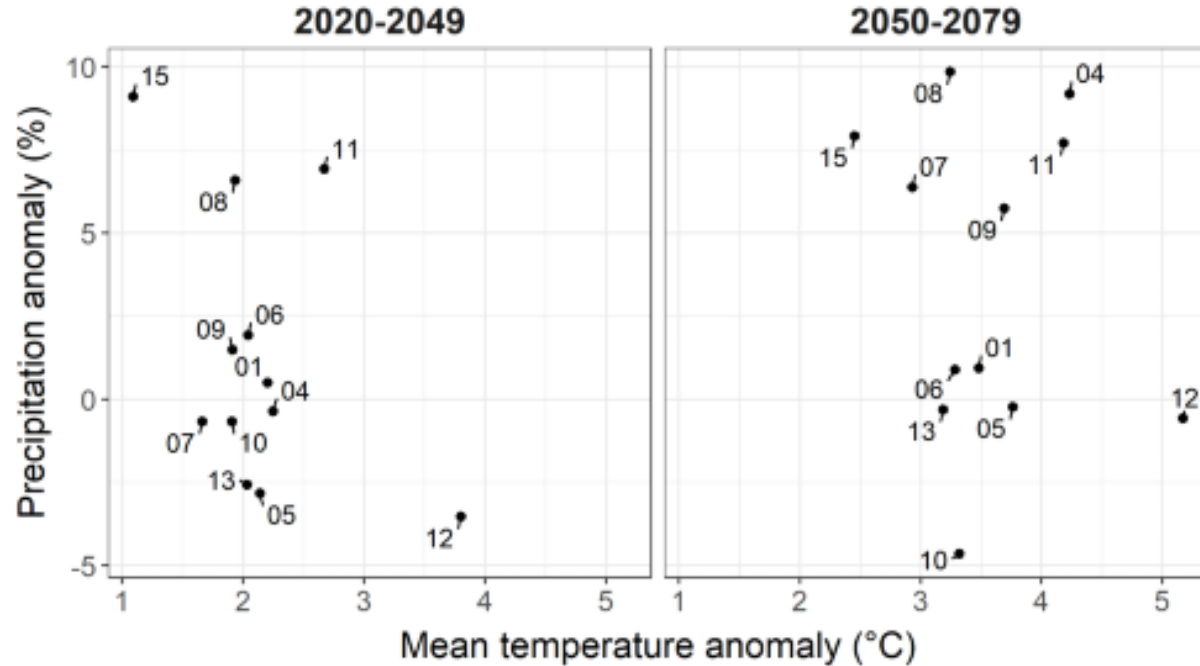
Fig. 5 Dispersal of *Ulopa reticulata* (adults and nymphs) into transplanted turfs at different distances from unmanipulated heath. For each distance the mean and 95% confidence interval for the mean is shown

Addendum 2



The James
Hutton
Institute

- Climate change predictions getting more detailed
- UKCP18 – 12 model simulations give a range of possible changes



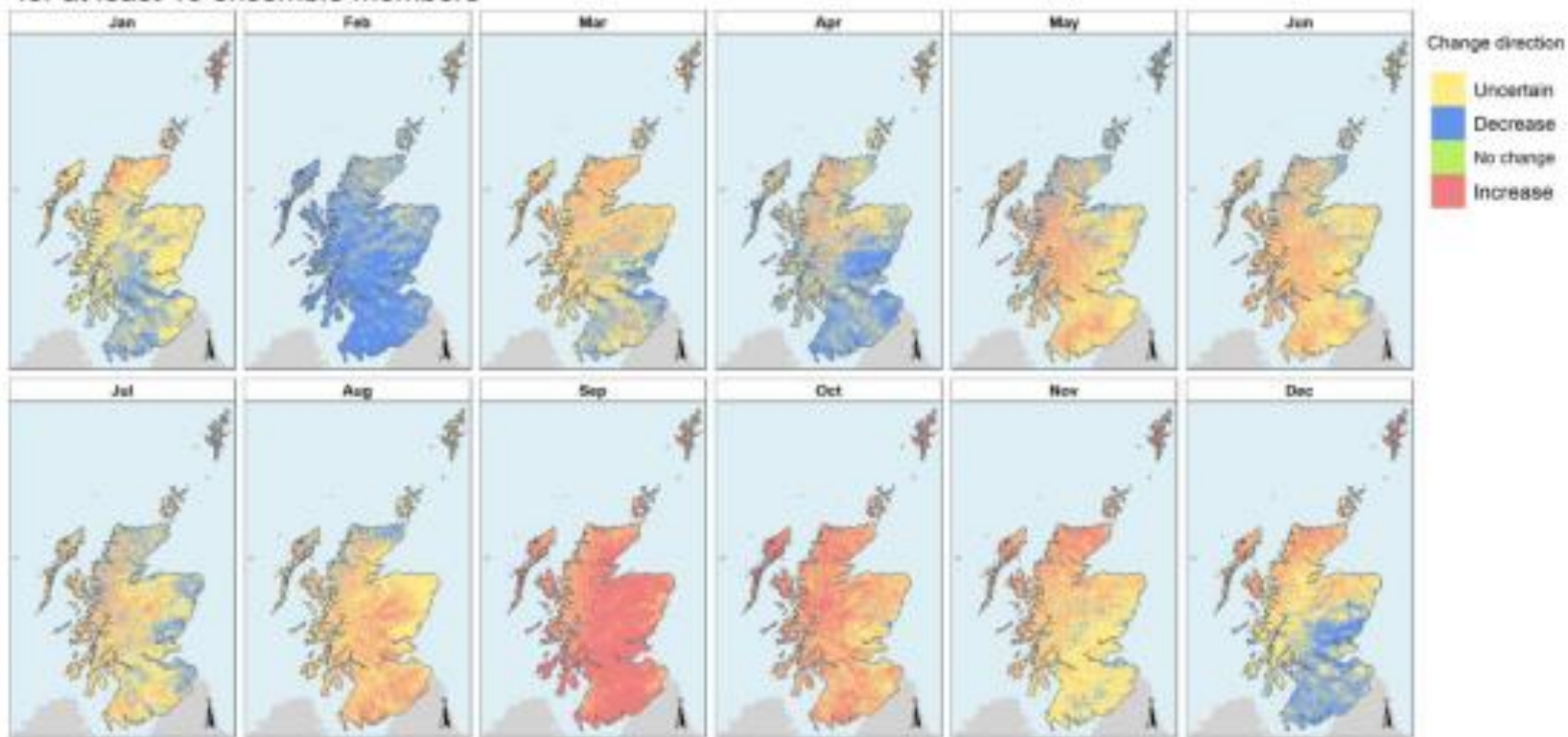
Rivington, M., Jabloun, M., Gimona, A., Martino, S., Aitkenhead, M., Glendell, M. & Gagkas, Z. (2022) Climate Extremes in Scotland. The James Hutton Institute, Aberdeen, Scotland. DOI: [10.5281/zenodo.7699842](https://doi.org/10.5281/zenodo.7699842)

Addendum 2



The James
Hutton

Change direction agreement for mean monthly consecutive dry days over the period 2020-2049
for at least 10 ensemble members





Thank you

- Macaulay Development Trust & Scottish Government's Strategic Research Programme
- Sarah Woodin, Louise Ross, Alison Hester, Thomas Cornulier
- The many landowners who helped with access and NatureScot



The James
Hutton
Institute