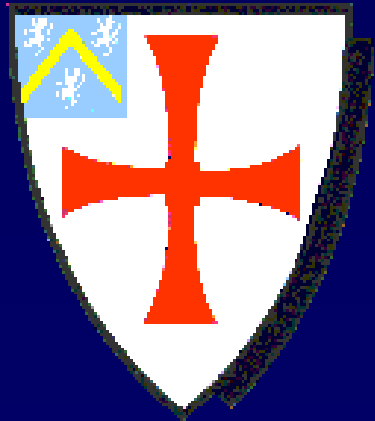


# Carbon storage in UK peatlands

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  - ✿ DEFRA
- The work is conducted with colleagues in Durham, Leeds, Manchester, CEH, Aberdeen

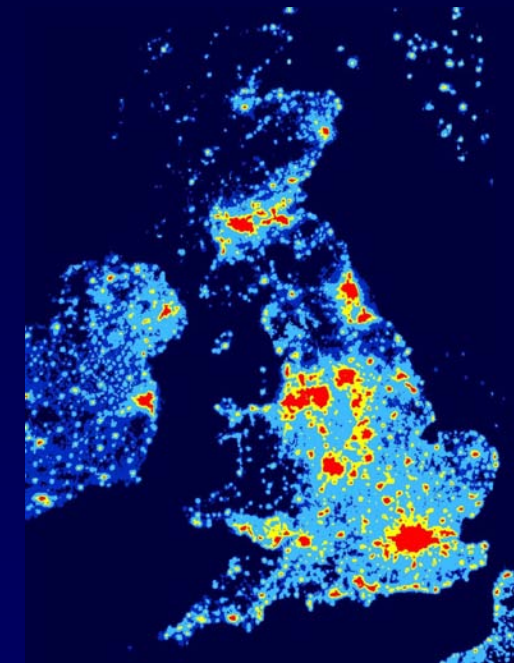
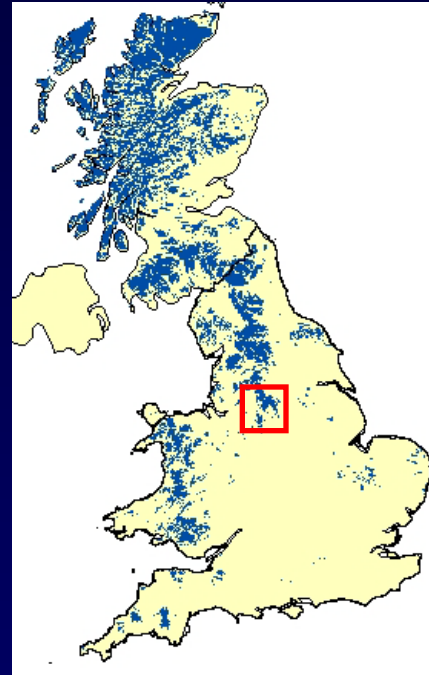
# Why be interested in peats?

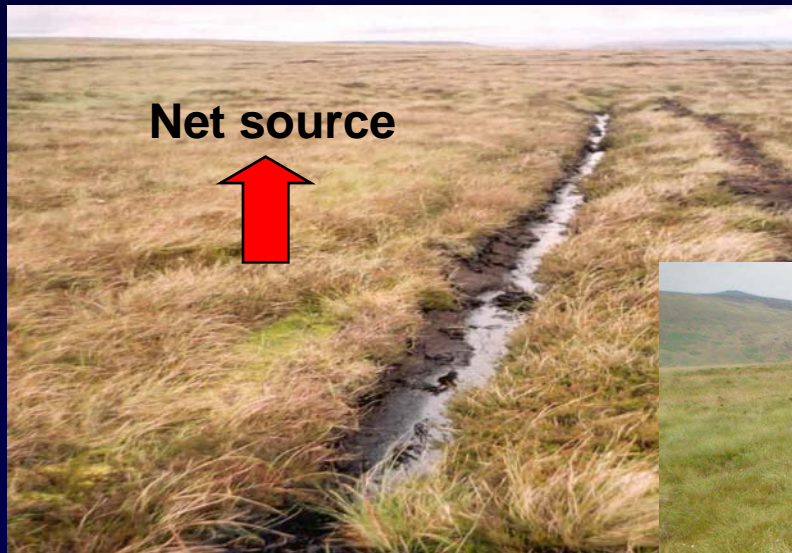
- UK peat is the country's largest terrestrial carbon store
  - ✱ More carbon stored than the forests of Britain and France combined
  - ✱ The amount of carbon stored is equivalent to 35 years of UK CO<sub>2</sub> output
- UK peat is a major water source in Northern Britain
  - ✱ Water colour is major water quality limitation
  - ✱ 55% of UK population get their water from a peat-covered catchment
- Between 40-50% of UK soil carbon is in 8% of its land area
  - ✱ Bellamy et al. said the 80% of UK soils carbon losses were in peats

# Why be interested in UK peats?

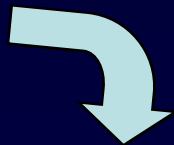


- Southern fringe of the Northern peats
  - ☀ Peat is a phenomena of cold/wet climates as climate zones move north the southern fringe is threatened
- UK peat is heavily managed
  - ☀ Burnt, grazed and drained
- UK peat is heavily impacted
  - ☀ Legacy of atmospheric deposition, wildfire and visitor pressure

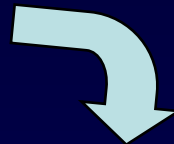




**Restore**



**Pristine**



**Avoided loss**

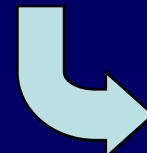


**Transitionary sink**

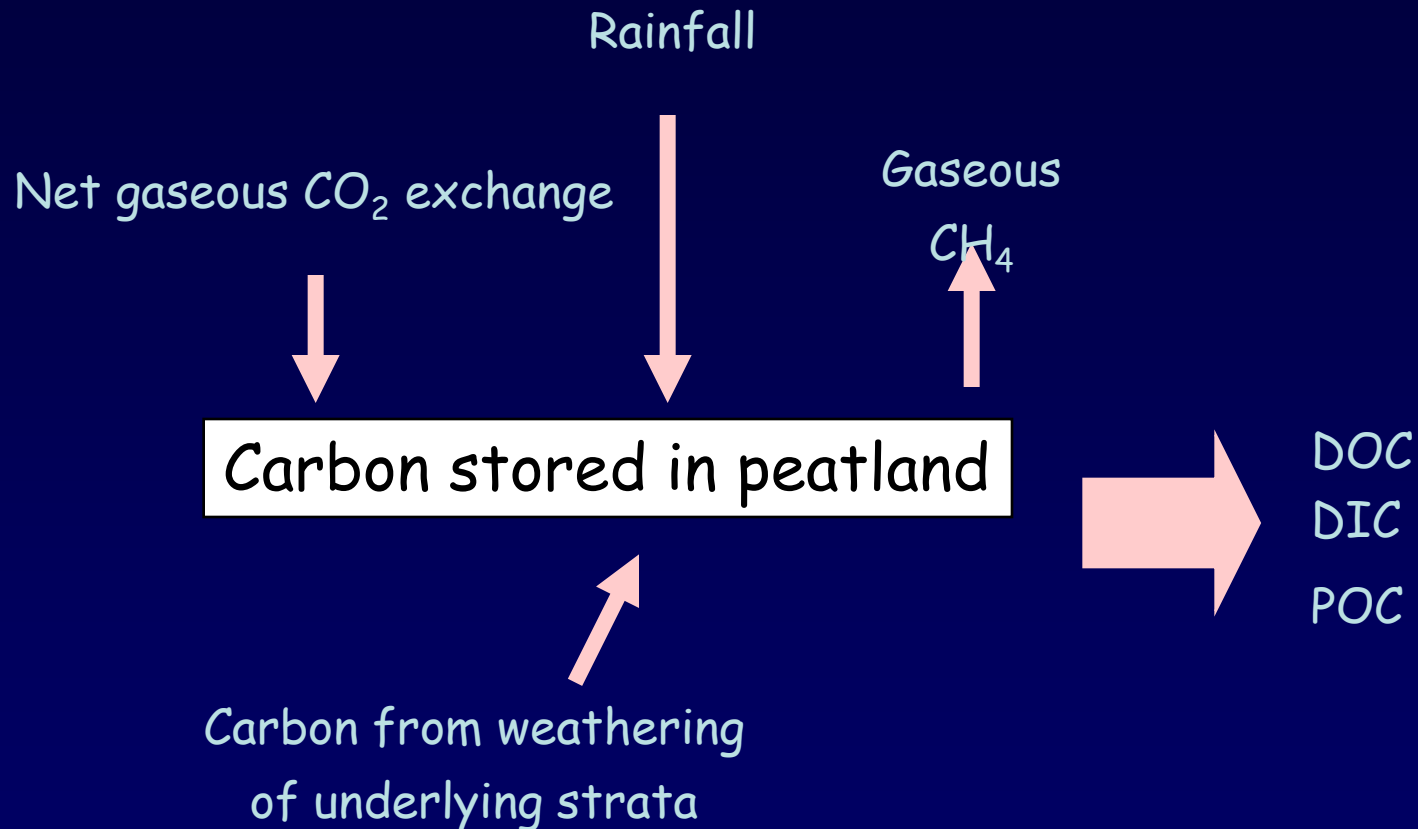


**Peat grows  
– mineral soils don't**

**Perpetual sink**

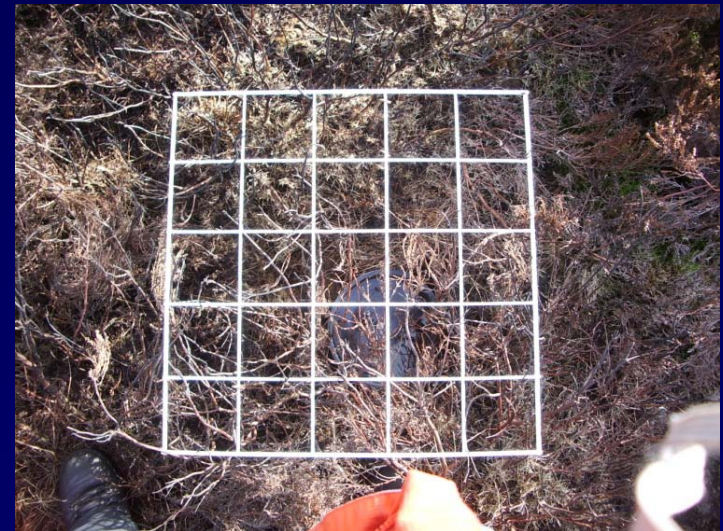


# Carbon uptake and release pathways for Moor House



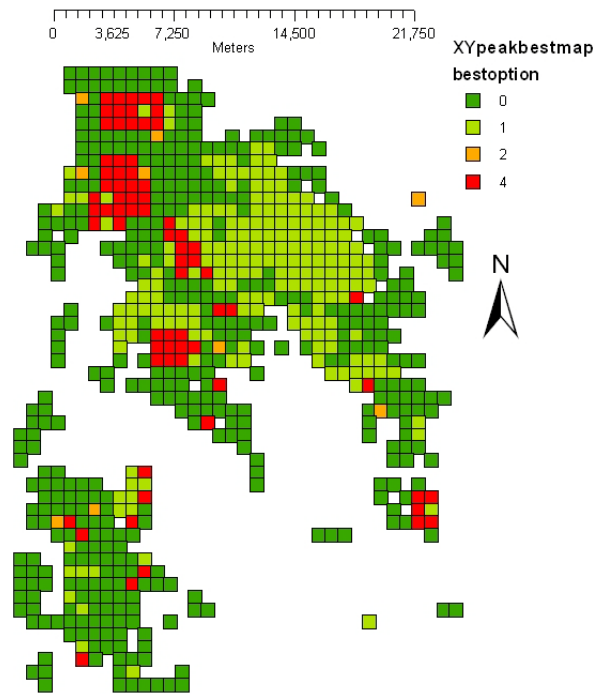
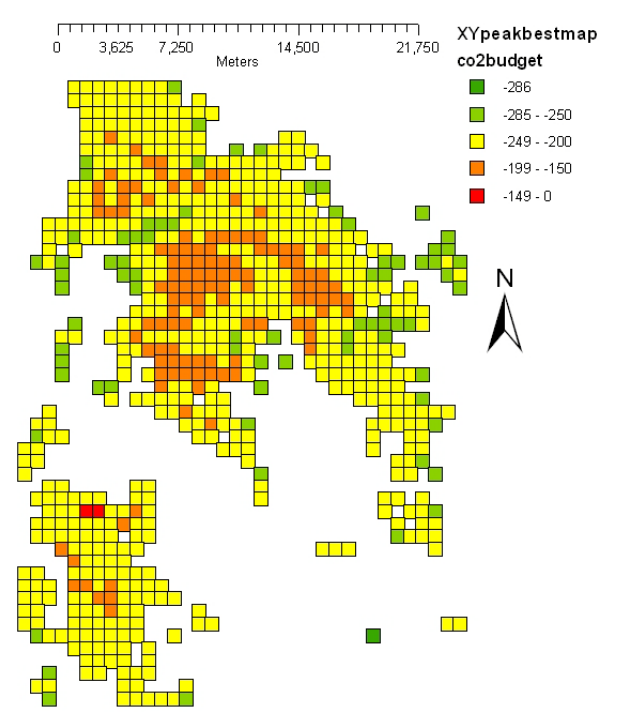
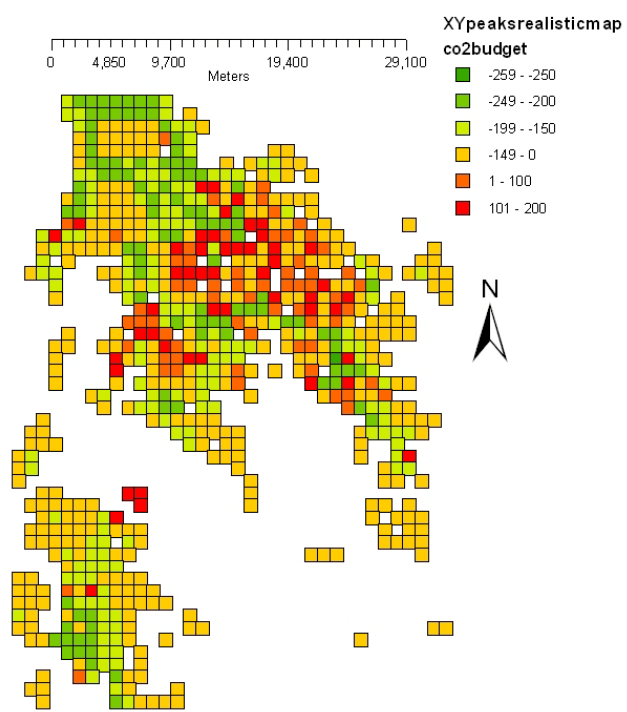
# What field projects are we doing?

- Covering carbon budgets with at least a year of data
- Bleaklow
  - ☀ Restoration
  - ☀ Gullies
  - ☀ wildfire
- Hard Hill
  - ☀ Burning vs. grazing
- Cronkley
  - ☀ Grip-blocking
- Goyt
  - ☀ Cutting vs. Burning
  - ☀ Altitude
- Pennine chain
- New experiments
  - ☀ Otterburn
  - ☀ Slope aspect



# Modelling optimal carbon budgets?

- What are the carbon budgets for the Peak District National Park?
- Covered 725km<sup>2</sup> including 550 km<sup>2</sup> of peat soil
- Calibration and validation is for Moor House
- Covered 10 years - 1997-2006
- Scenarios considered
  - ✱ Cessation of grazing
  - ✱ Cessation of managed burning
  - ✱ Grip/gully blocking
  - ✱ All of the above



# What is the capacity?

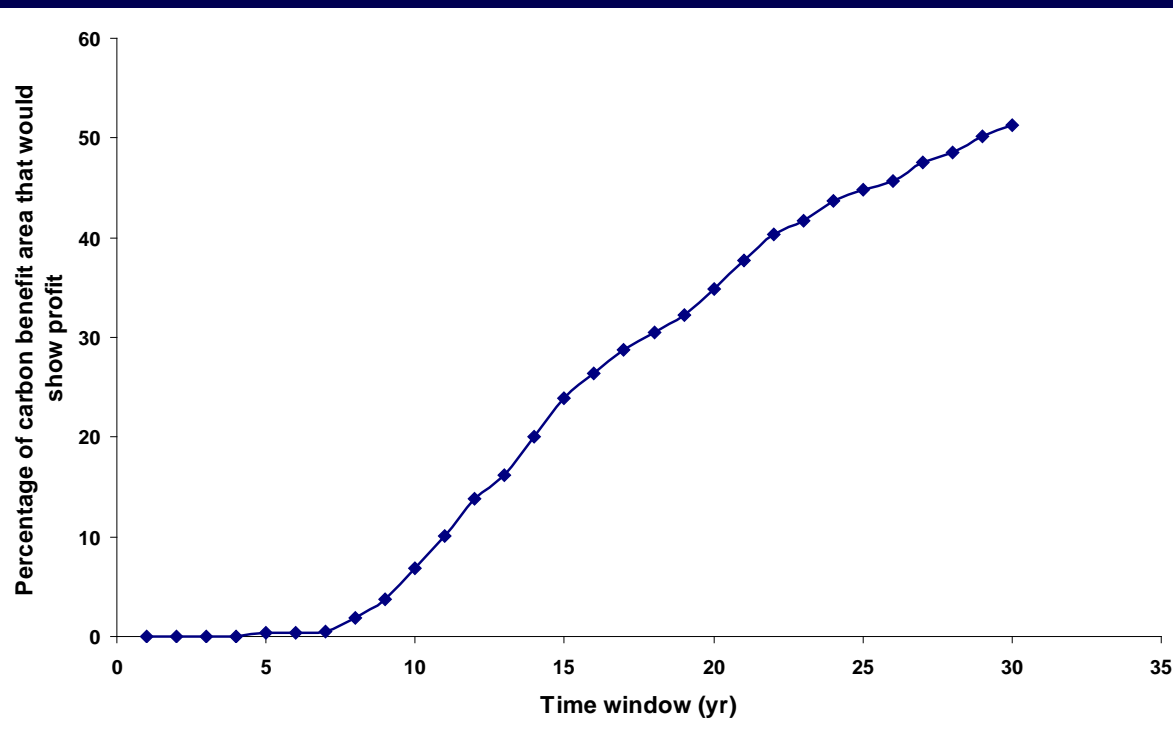
- The study region is presently a net sink of CO<sub>2</sub>
  - ✱ -62 Ktonnes CO<sub>2</sub> equivalent
  - ✱ -136 tonnes CO<sub>2</sub> eq/km<sup>2</sup>/yr
- Under optimised conditions
  - ✱ -160 Ktonnes CO<sub>2</sub> equivalent
  - ✱ -219 tonnes CO<sub>2</sub> eq/km<sup>2</sup>/yr

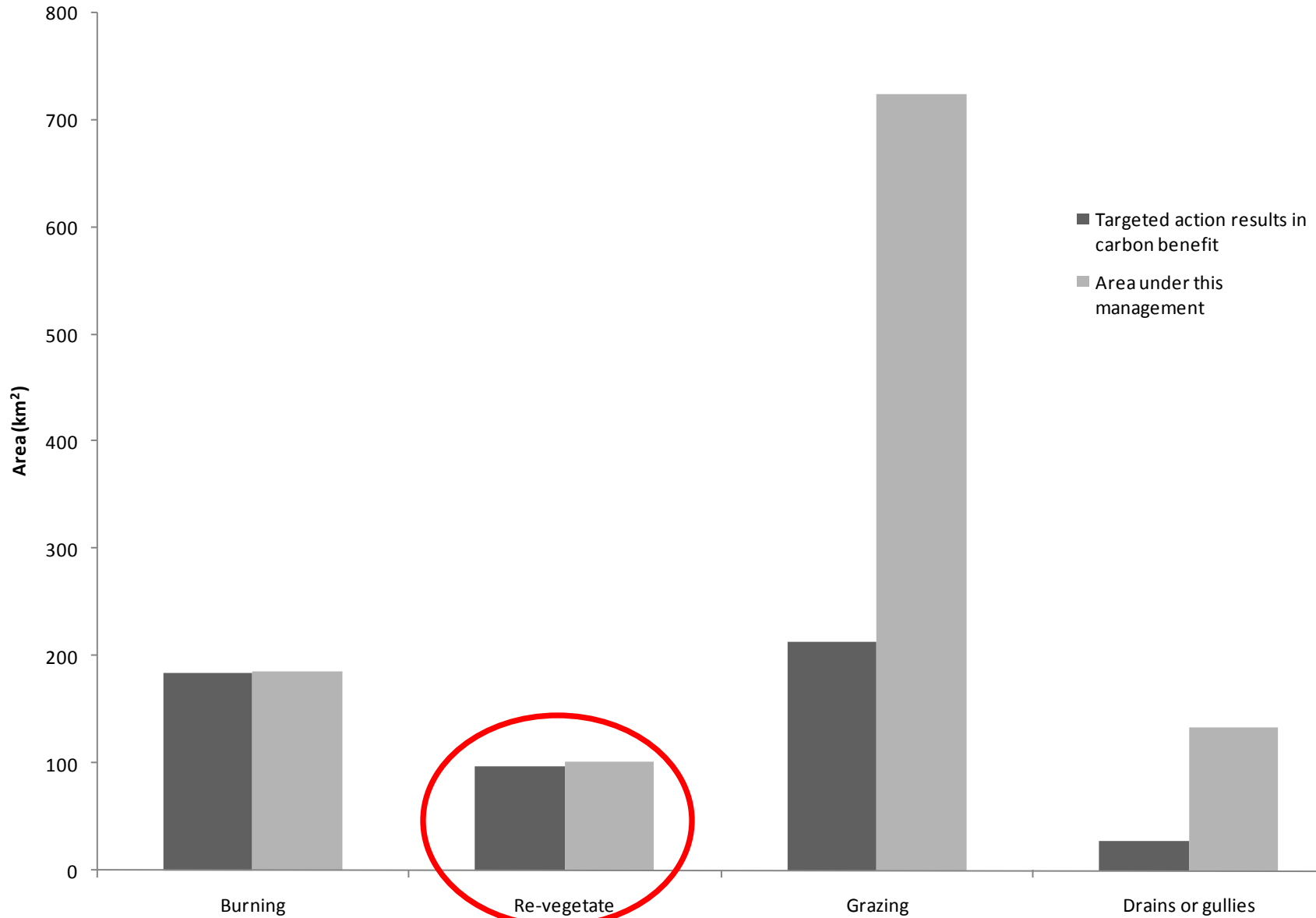
# The profit from peatland restoration?

- In the Peaks 281 out of 725 km<sup>2</sup> showed there could be carbon benefit from intervention

## ■ Assuming

- ☀ Restoration cost of £2250/ha
- ☀ Shadow price of carbon between £13 and £39 /tonne CO<sub>2</sub>
- ☀ Restoration rates of upto 39 years





$$R < \frac{1}{2} \epsilon (\Delta CO_2) \left( \frac{T_P (T_P + 1)}{T_P} \right)$$

# Does restoration actually bring a benefit?

- No point even thinking about this if changing management or restoring cannot be shown to give benefit
- Monitoring restoration on Bleaklow following the April 2003 wildfire

## ✱ Restoration with:

- Liming
- Re-seeding
- Brashing
- Geo-jute

## ✱ Monitoring carbon budget



Control



Geojetted gully

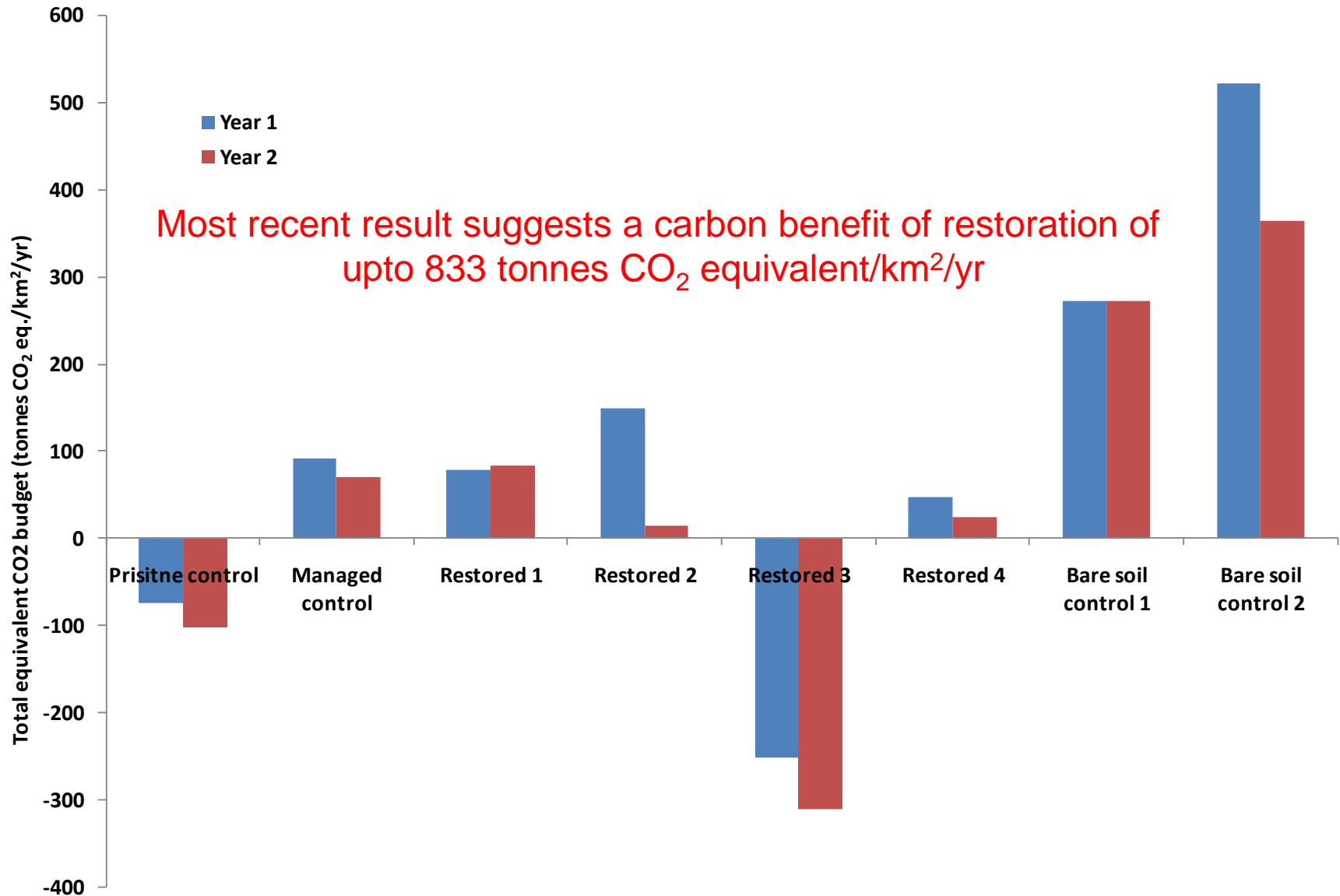


Bare peat gully

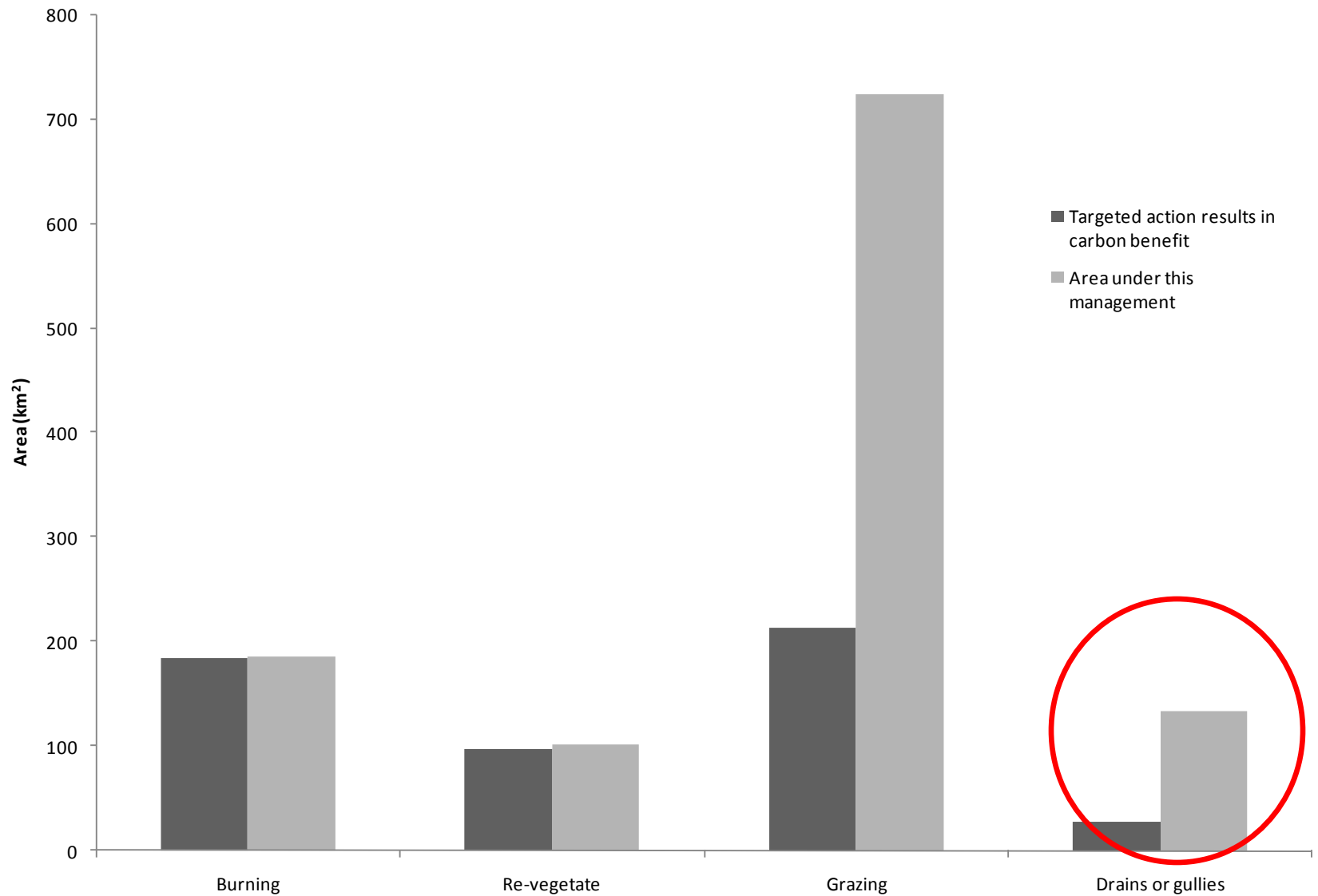


Limed & seeded

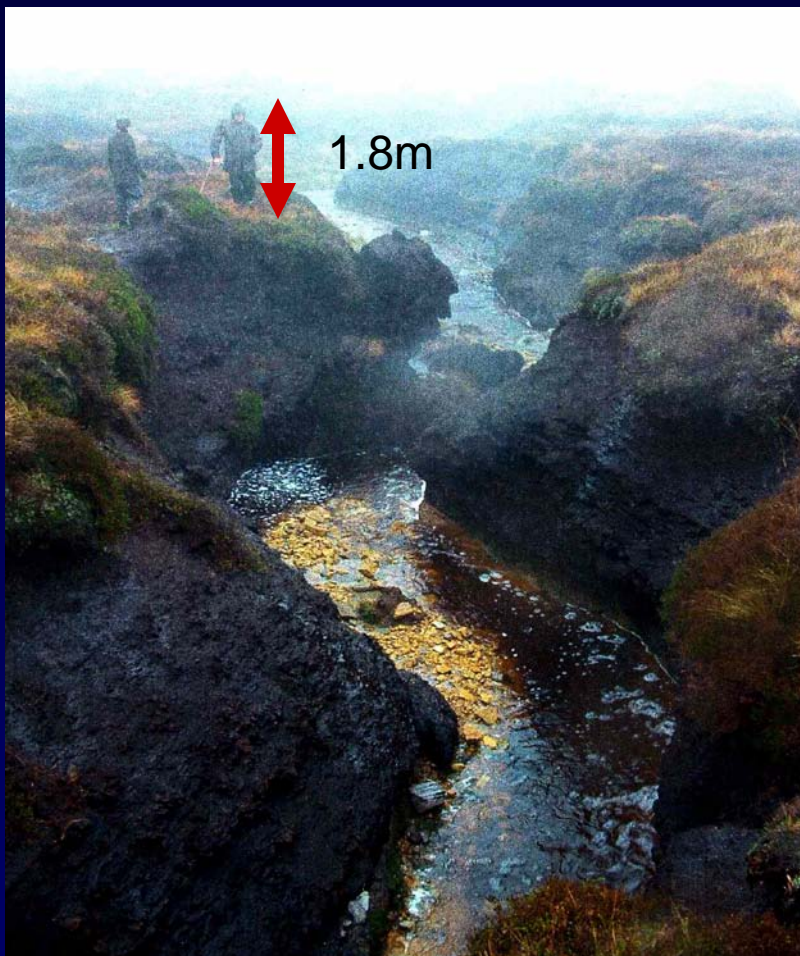
# GHG benefit of revegetation



# Bad news 1



# But what do we do with the grips and gullies?



Courtesy of Natural England

- Rewetting is too risky
  - ✱ Unless we can target efficiently
- Are there new ways of dealing with grips/gullies?
  - ✱ New block types
  - ✱ Revegetate rather than rewet
- Do we have view everything from GHG perspective?
  - ✱ Ecosystem services approach
  - ✱ Protect a landscape
- Have got good enough view of the science?
  - ✱ How much POC or DOC is recycled to the atmosphere?
- What happens if we don't?
  - ✱ Could future climate change make this worthwhile?

# Do we have a good enough view of the science?



## ■ Cronkley experiment

- ☀ Grippped site
- ☀ Two sets of grips both monitored for a year before blocking
- ☀ One set of grips left open, one set blocked
- ☀ Monitored all carbon pathways

## ■ What are results so far?

- ☀ DOC flux significantly declines (not concentration)
- ☀ Methane goes up
- ☀ Primary productivity increases

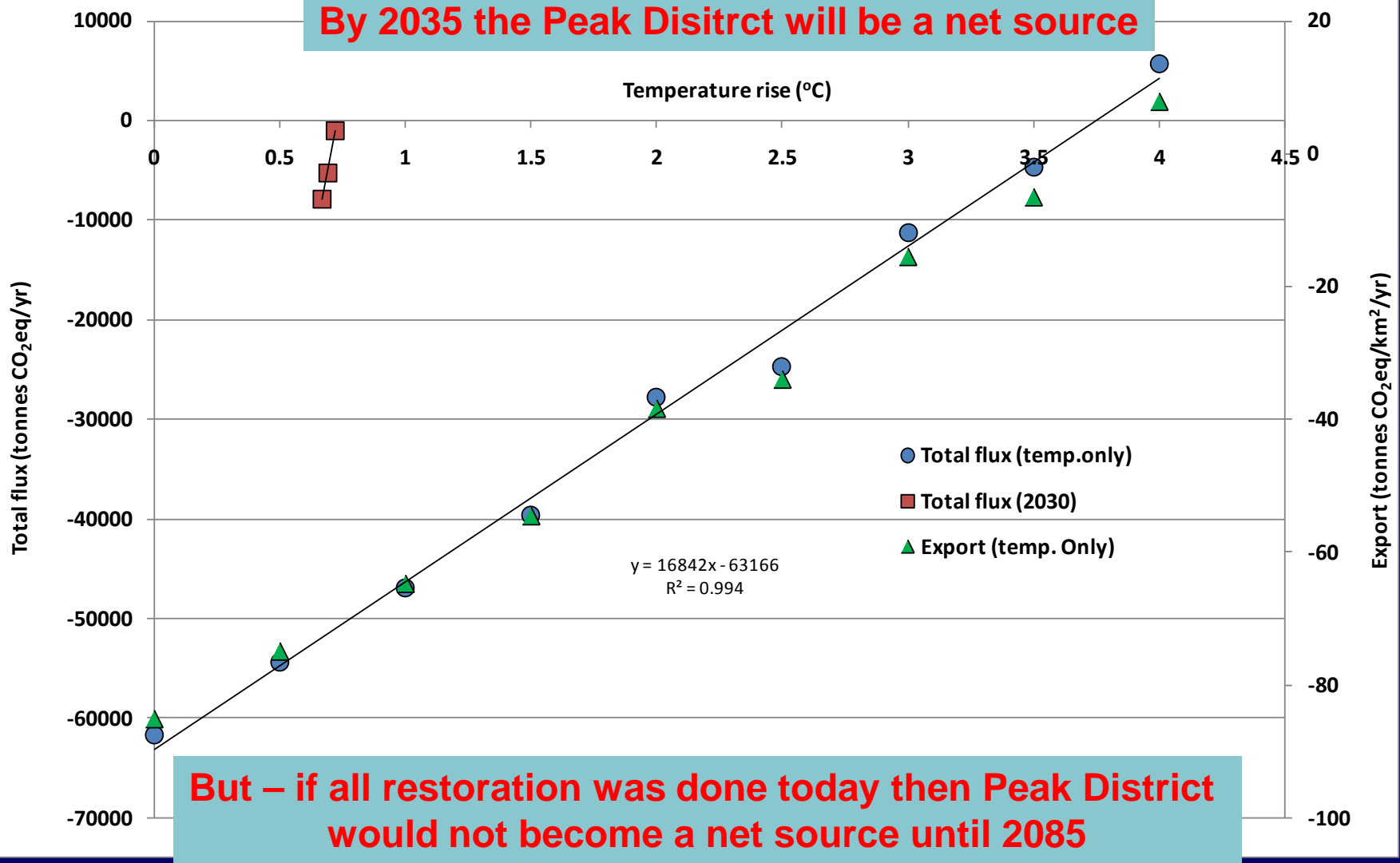
- ## ■ The increases in PP and decrease in DOC outweighs increase in CH<sub>4</sub>

# What is risky? What is uncertain?

Management	Effective sample size	Effective sample size (GHG)	Probability of improvement (Carbon)	Probability of improvement (GHG)
Afforestation	8.8	8.8	0.78 ( $\pm 0.17$ )	0.92 ( $\pm 0.27$ )
Managed burning	4.0	3.0	0.07 ( $\pm 0.01$ )	0.4 ( $\pm 0.03$ )
Deforestation	0.8	0.3	0.2 ( $\pm 0.15$ )	0.14 ( $\pm 0.12$ )
Drainage	9.8	11.7	0.2 ( $\pm 0.02$ )	0.5 ( $\pm 0.08$ )
Drain-blocking	7.0	8.1	0.50 ( $\pm 0.12$ )	0.31 ( $\pm 0.04$ )
Grazing	3.0	2.3	0.65 ( $\pm 0.29$ )	0.78 ( $\pm 0.33$ )
Revegetation	4.9	5.5	0.96 ( $\pm 0.33$ )	0.66 ( $\pm 0.11$ )

# Bad news 2

**By 2035 the Peak District will be a net source**



# Some things we don't know?

- Heather cutting?
- Grazing intensity
- Deforestation
- Char production



# Conclusions

- Not all restorations are good for GHG
- There will be no immediate financial bonanza
- Some restoration will be viable in some places
- We must have a more ecosystems view of our peatlands

