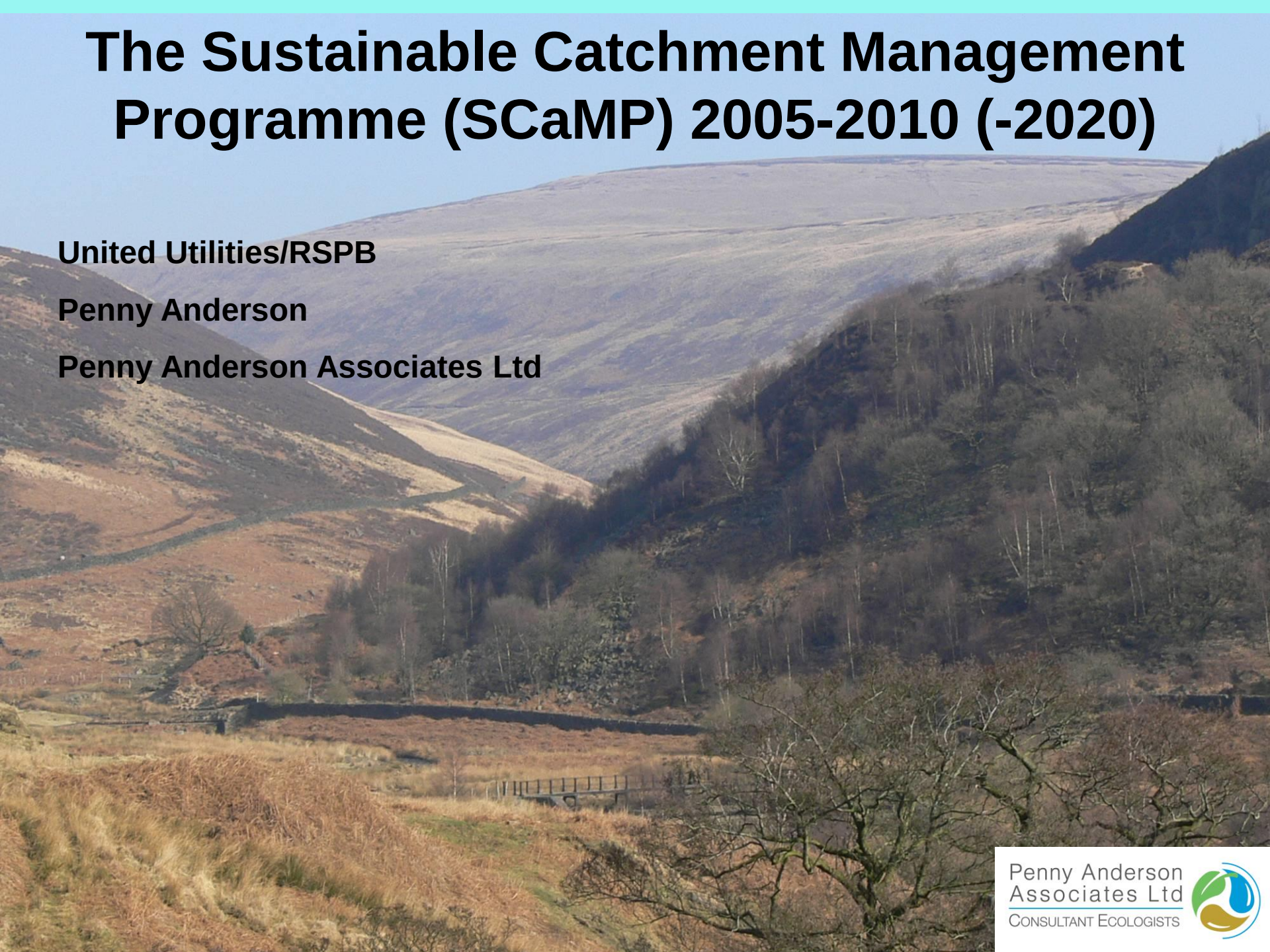
The Sustainable Catchment Management Programme (SCaMP) 2005-2010 (-2020)



United Utilities/RSPB

Penny Anderson

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Background

- Innovative, large scale project
- Aim to improve:
  - biodiversity condition
  - raw drinking water quality
- Reduce runoff rates, sediment load and downstream flooding
- Reduce erosion and loss of carbon
- Increase carbon sequestration
- Provide a sustainable future for tenants
- Support regional BAP habitats and species

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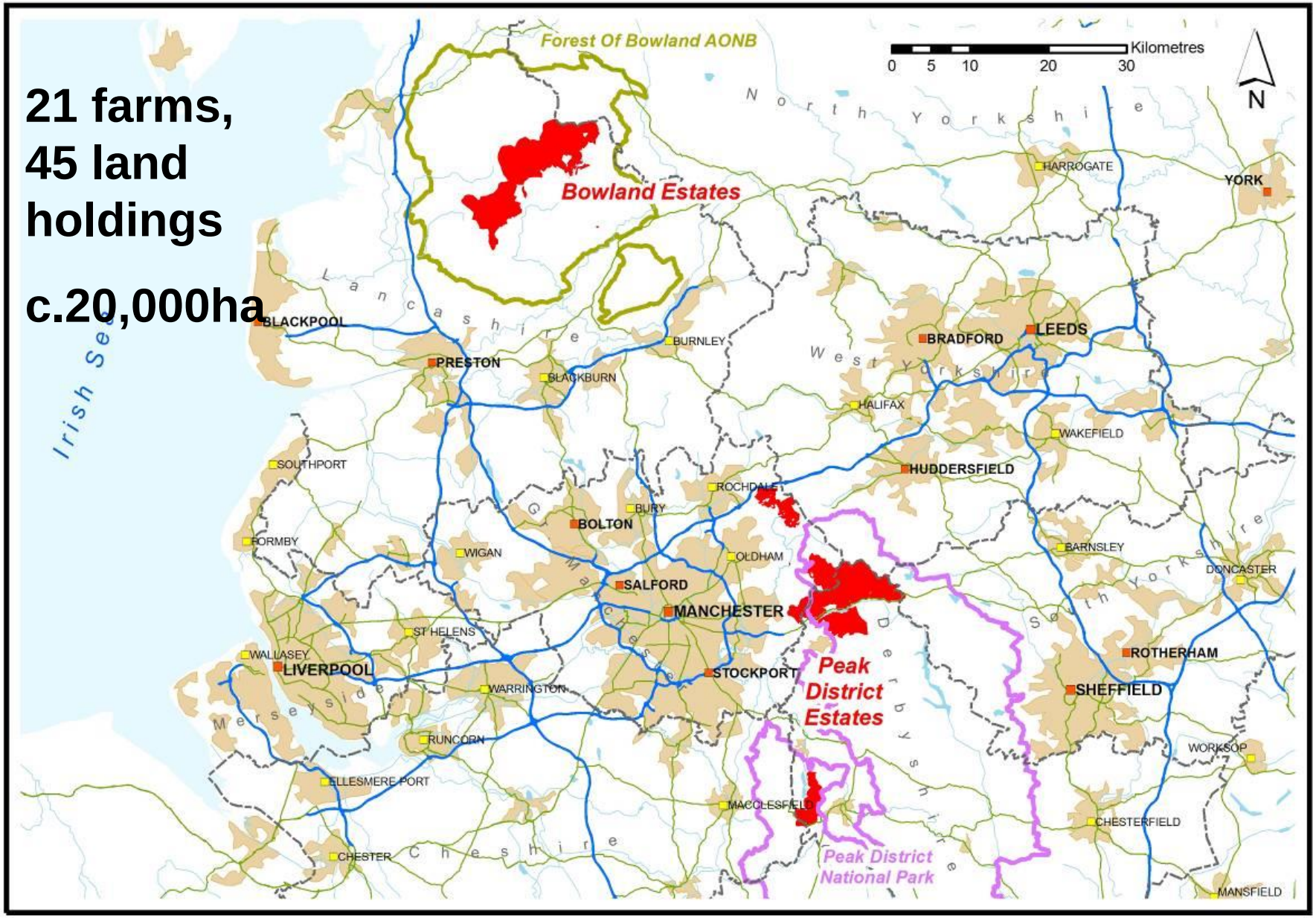
Where?

21 farms, 45 land holdings

c.20,000ha



Innovative

- United Utilities owns c. 57,000 ha in NW Region
- 17,500ha designated as SSSI
- Own land to protect raw water quality for 6.7million people
- First project where regulators permitted catchment management as part of AMP process
- As a regulated Utility Undertaker, UU has obligations to take biodiversity and habitat

  into account, although

  not funded to do so

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Landscape Scale Approach – multiple benefits

- Sustainable catchment management plans
- Work closely with tenant farmers, keepers etc
- Implement works in a partnership approach
- RSPB - agri-environment support
- UU invested in infrastructure and other capital works.

Budget £12.5million 2005-2010

- £10.5million on restoration works
- £2million on capital investments

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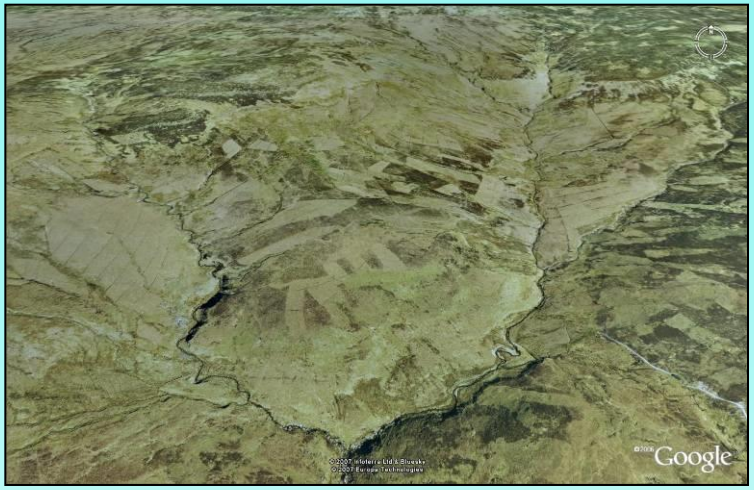
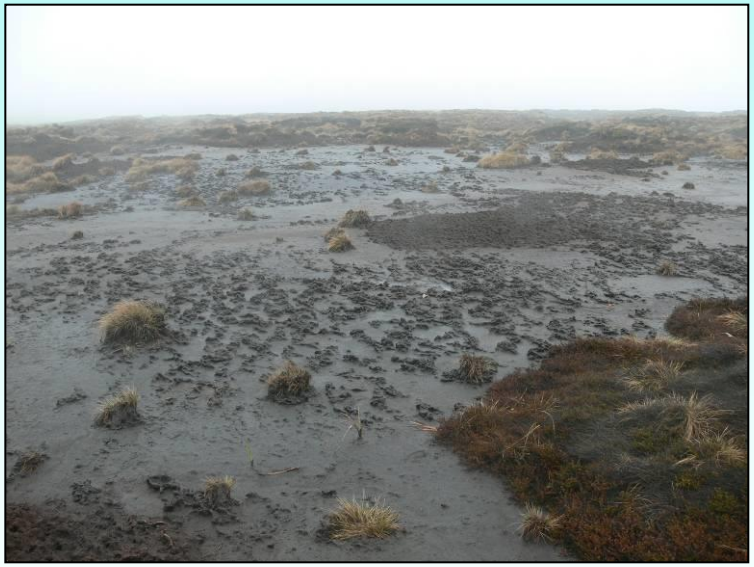
Measures

- grip blocking 85.23km in the Goyt and Bowland
- re-vegetation of eroding bare peat 470ha, plus some gully blocking
- restoring dwarf shrub heath





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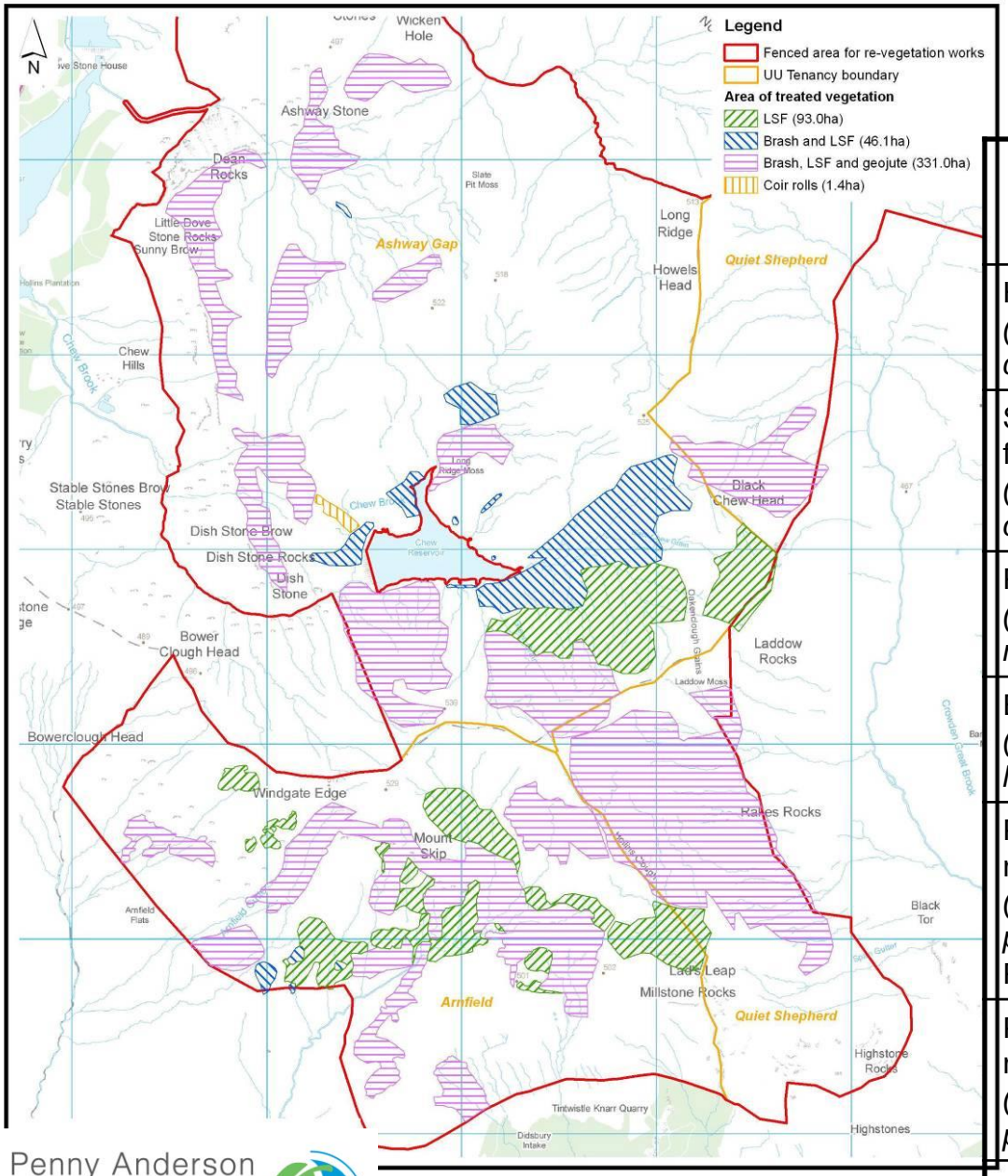
Restoration of bare peat



Grass species	% weight	Kg ha^{-1}	Other additions
Highland Bent *(Agrostis castellana)*	6	2.43	Wavy hair-grass *(Deschampsia flexuosa)* added where seed available Lime @ 1 t ha^{-1} NPK 10:30:15 fertiliser @ 250 kg ha^{-1}
Sheep's fescue *(Festuca ovina)*	15	6.09	
Red fescue *(Festuca rubra rubra)*	19	7.91	
Blue fescue *(Festuca longifolia)*	15	6.09	
Perennial ryegrass *(Lolium perenne* Romark)	24	9.74	
Perennial ryegrass *(Lolium perenne* Rio)	21	8.52	
Totals	100	40.78	

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Measures cont.

- woodland enhancement -111ha
- planting new upland oak and wet woodland - 516ha
- hay meadow improvements-109ha
- 250ha rush pastures -100 scrapes + rush cutting
- new bridges, water troughs, stream fencing - reduces pathogens in water
- 9 new stock buildings - indoor wintering and lambing
- new waste management facilities - reduce run-off to water courses

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Monitoring 2005-2015 (and beyond)

- Hydrological and vegetation effects of grip blocking - Whitendale and Brennand + Goyt Estate
- Bare peat re-vegetation treatments on Ashway Gap, Quiet Shepherd & Arnfield Estates - vegetation and hydrology
- Vegetation response to changes in sheep stocking levels - 2 Estates, Bowland
- Vegetation response to restoration of acid grassland to dwarf shrub-rich vegetation - 4 sites

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Monitoring methods

- Monitored:
  - Water colour and turbidity at sub catchment scale - daily
- Stage in river – 15mins
- Dip wells across grips – 15mins
- Vegetation biennially

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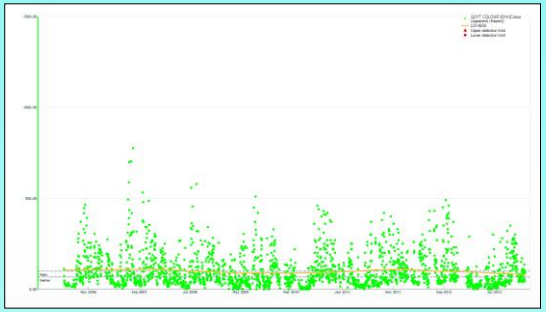
Colour in water

Type 1 Goyt and Whitendale steams, Hazen<500, grip blocking

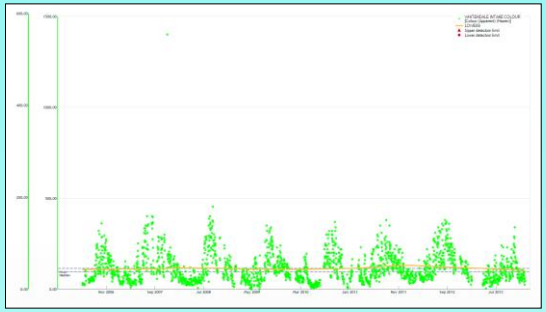
Type 2 Higher colour, >500, more peat in catchment, Brennand, grip blocking 2008-2009

Type 3 Ashway Gap – very high colour levels, degraded, gullied catchment, re-vegetated, gully blocking 2007

Type 1 Colour Pattern (catchment response)

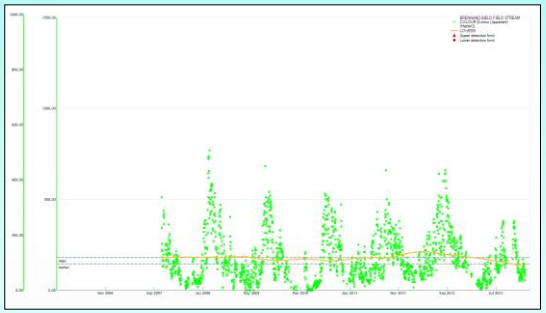


Goyt Raw Water Colour (2006-2014)

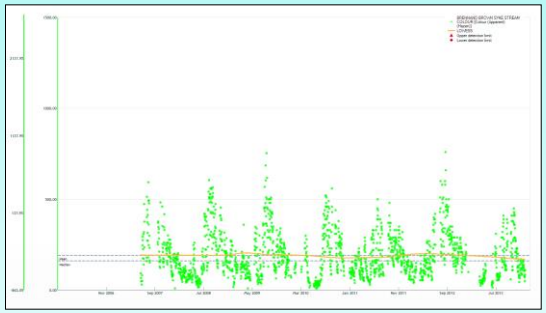


Whitendale Intake Raw Water Colour (2006-2014)

Type 2 Colour Pattern (catchment response)

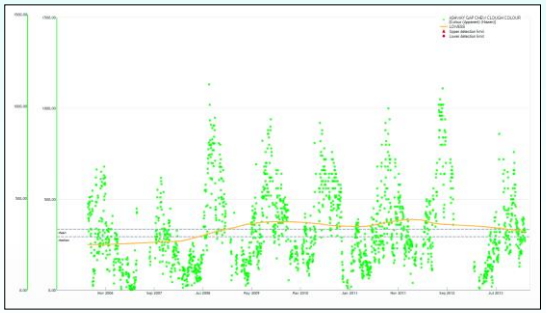


Brennand Bield Field Stream Raw Water Colour (2007-2014)

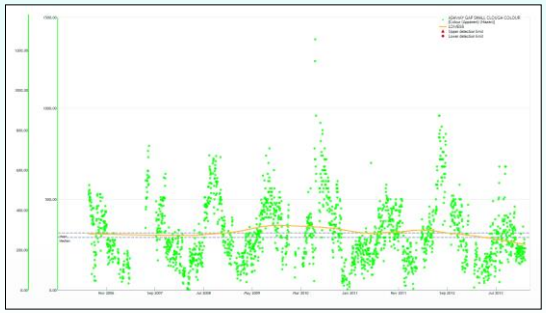


Brennand Brown Syke Stream Raw Water Colour (2007-2014)

Type 3 Colour Pattern (catchment response)



Ashway Gap Chew Clough Raw Water Colour (2006-2014)



Ashway Gap Small Clough Raw Water Colour (2006-2014)

Legend

Green dots: True colour (Hazen) measured daily
Dashed grey lines: Series mean and median values
Orange line: Locally weighted average (LOWESS) of series

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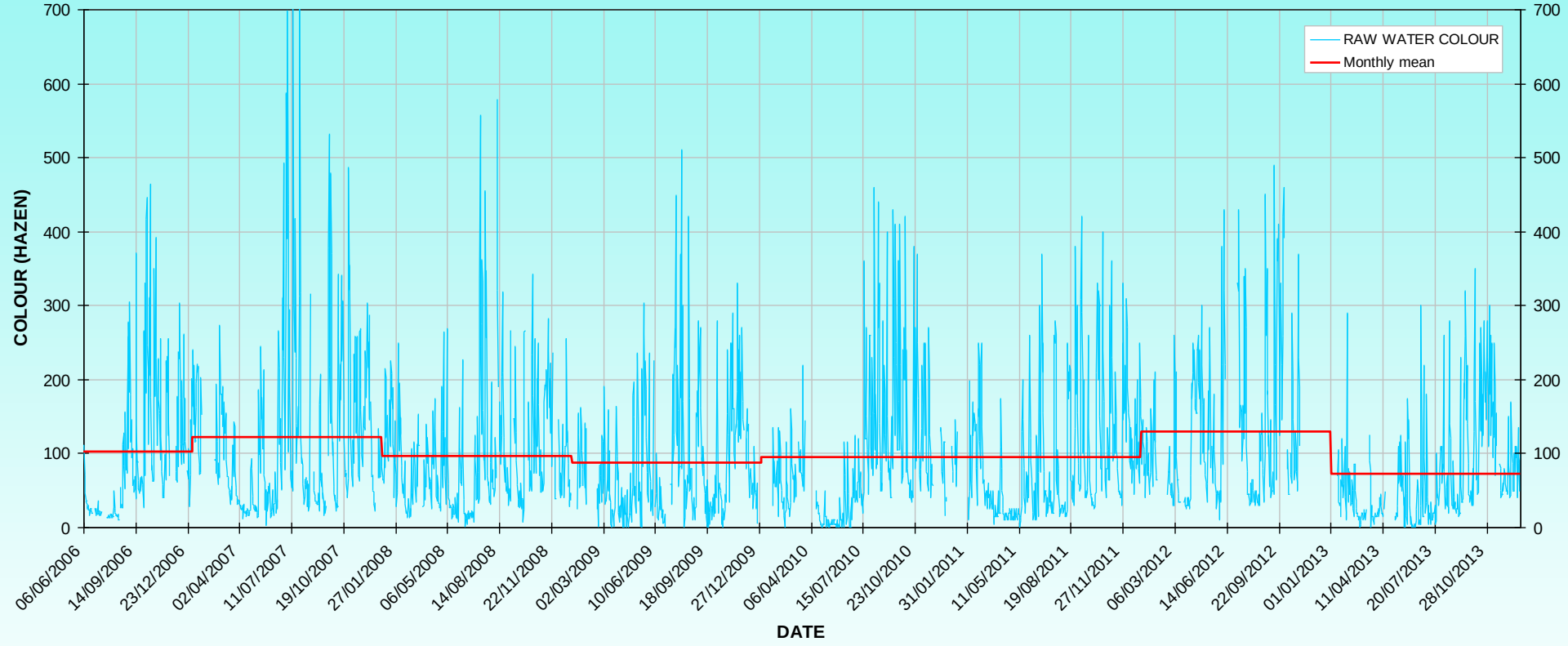
Effects of grip blocking on colour

Goyt



All sites - small, but statistically significant decline in raw water colour after 2 years in Brennand and Goyt, after 5 years in Whitendale

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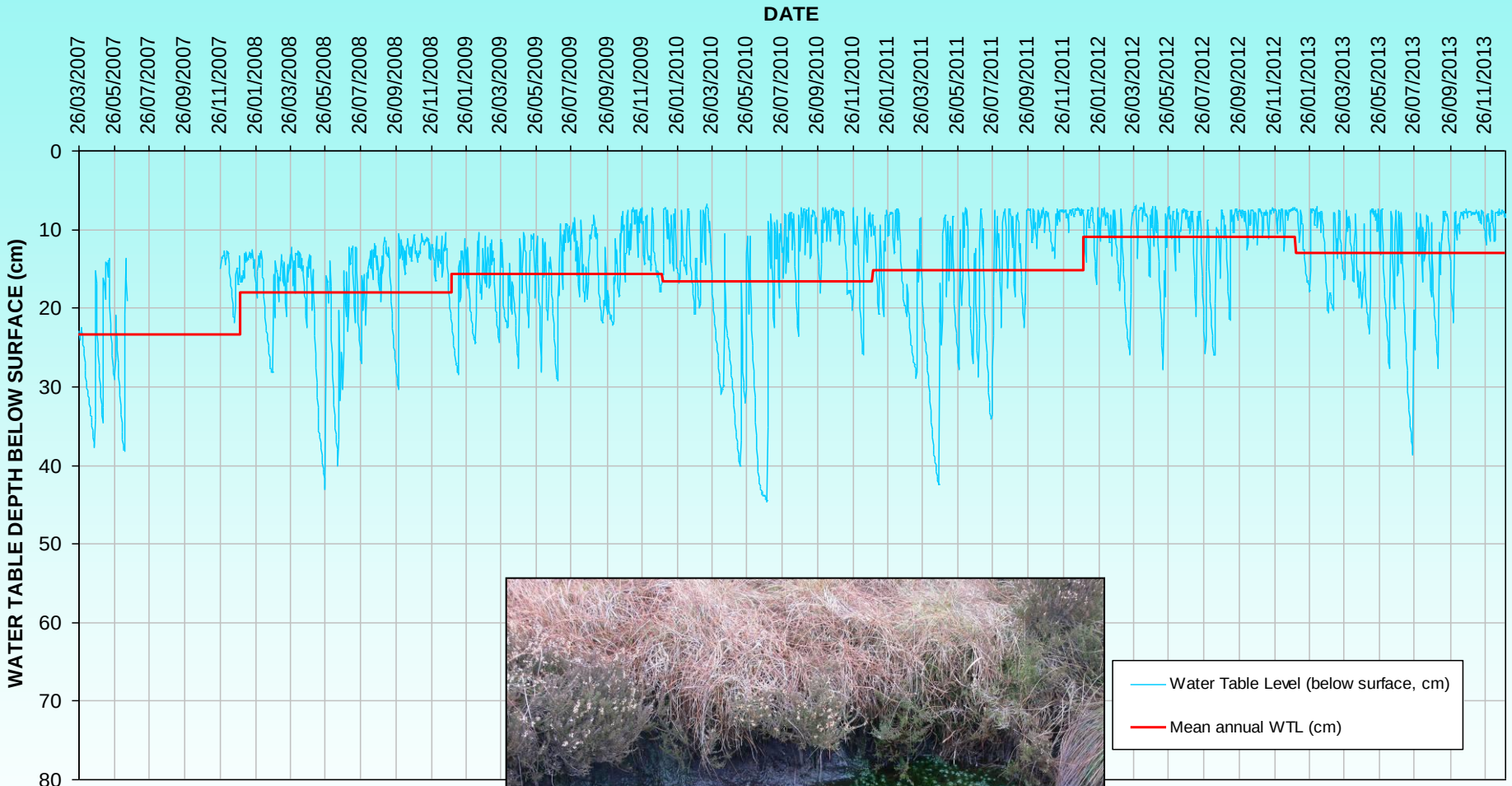
Effects on water table



Statistically higher water table in Goyt

Lower perturbations

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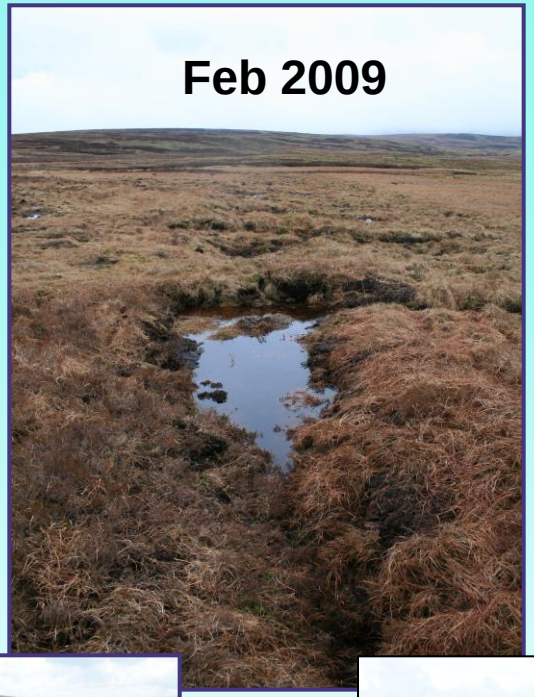
Grip blocking on Brennand, Bowland



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Carbon savings Goyt

	Total DOC Loss Per Year	DOC Loss kg/Year/ Hectare	Mean DOC Loss Per Day	Median DOC Loss Per Day
September 2006 - September 2007	67,355kg	89kg	206kg	72kg
September 2007 - September 2008	48,121kg	64kg	145kg	53kg
September 2008 - September 2009	38147kg	51kg	115kg	41kg
September 2009 - September 2010	37,090kg	49kg	102kg	31kg

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Other effects

- Flooding
  - No effects found

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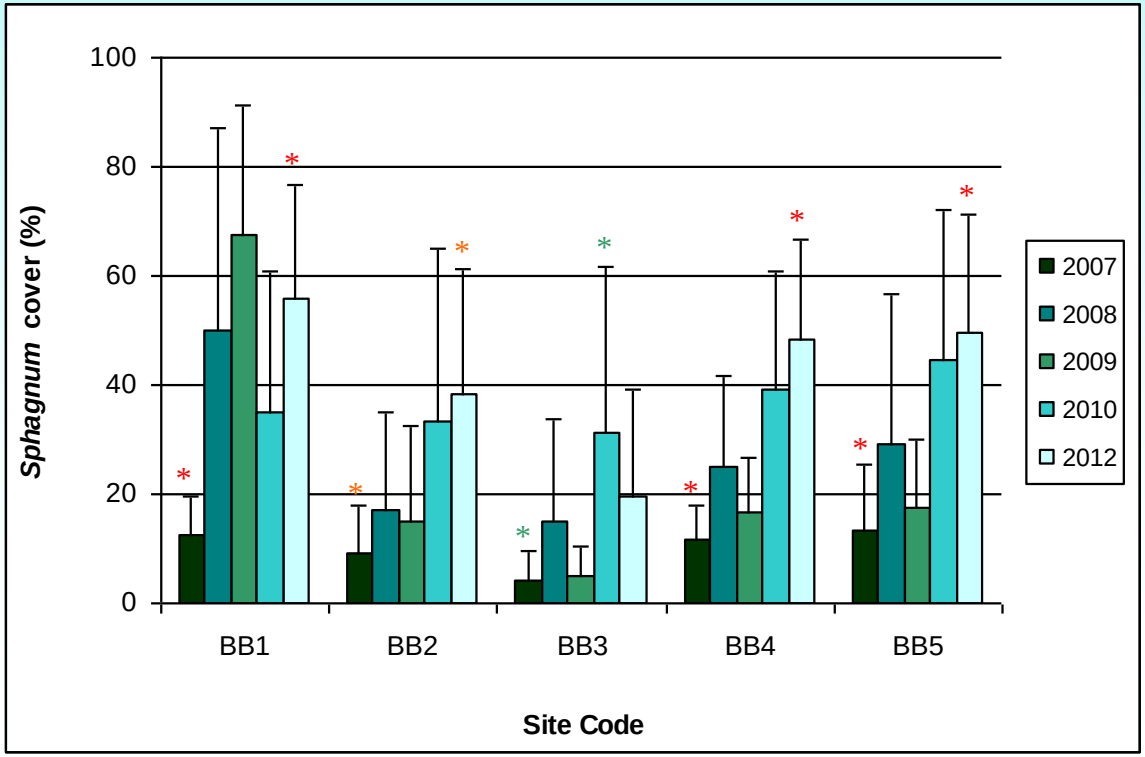
Sphagnum Cover Brennand

before (2007) and after (2009–2012) Restoration Measures

*(*Mean and Standard Deviation) BB1 – reference site, BB2 and BB3 - grips blocked eroded catchment, BB4 and BB5 - grips blocked uneroded catchment

Blanket bog species showing trends for increases – cranberry, bog asphodel, bog rosemary, cross-leaved heath, crowberry



Mostly *Sphagnum fallax*

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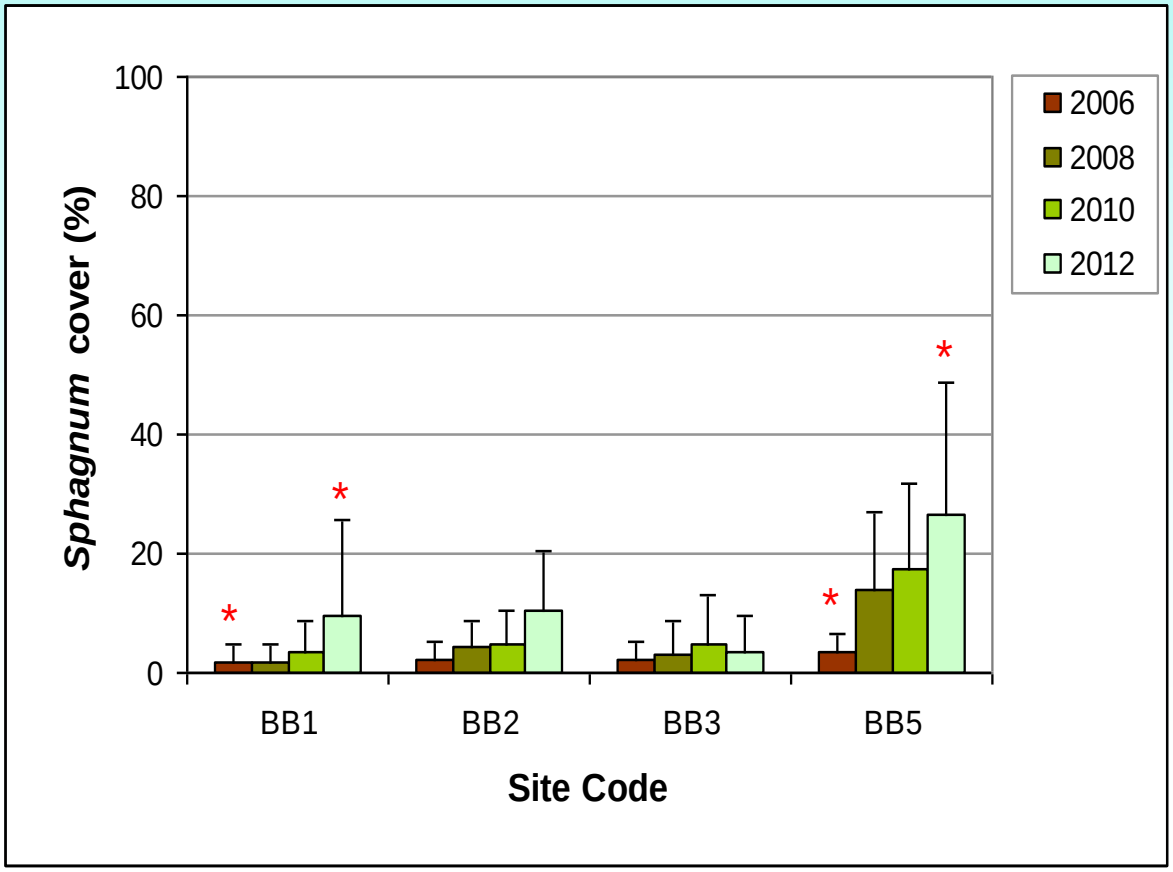
Sphagnum Goyt

Goyt - ***Sphagnum*** cover after grip blocking, stock reduction and stopping of burning

BB1 and BB2 - peat-blocked grips

BB3 - reference site grips, unblocked

BB5 - plastic-blocked grips



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Other species

BRENNAND

Cottongrasses – no consistent trend

Wavy hair-grass – increase then decline

Heather – increase then decline

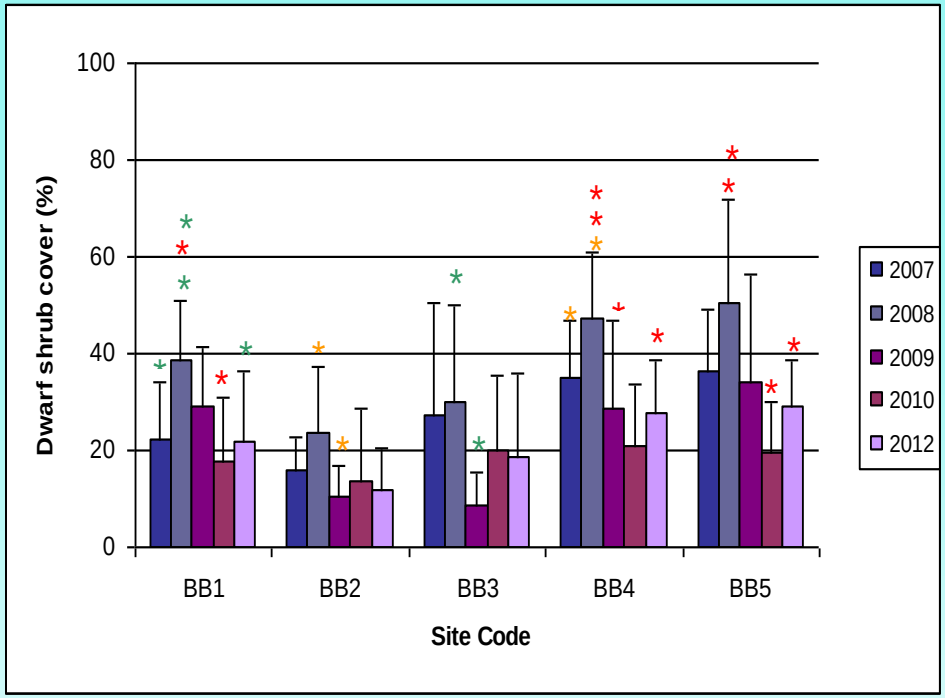
Bilberry – decline on some sites not on others

Other mosses – increases after grazing reduced, not with grip blocking

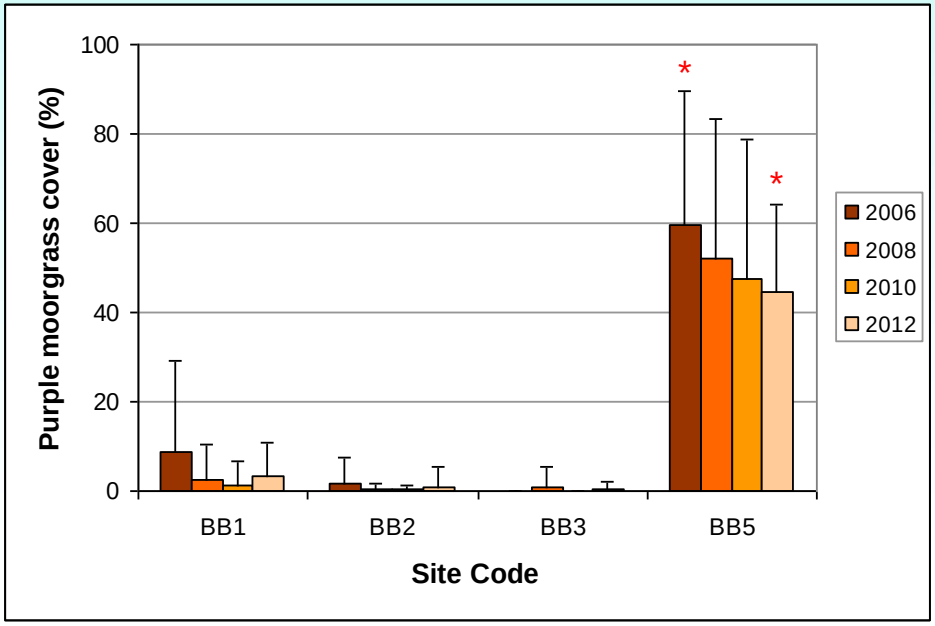
Most differences reflect reduced grazing

GOYT

Reduction in *Molinia* 1 plot



Dwarf shrubs Brennand



Molinia Goyt

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Longdendale Vegetation Results

2011

Lime, nurse seed & fertiliser Plot 2007 prior to treatment (left) & 2012 (right),

Geojute

No geojute

Lime, nurse seed, fertiliser, brash + Geojute 2007 (left) 2012 (right)

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Longdendale Results – Grass Nurse crop

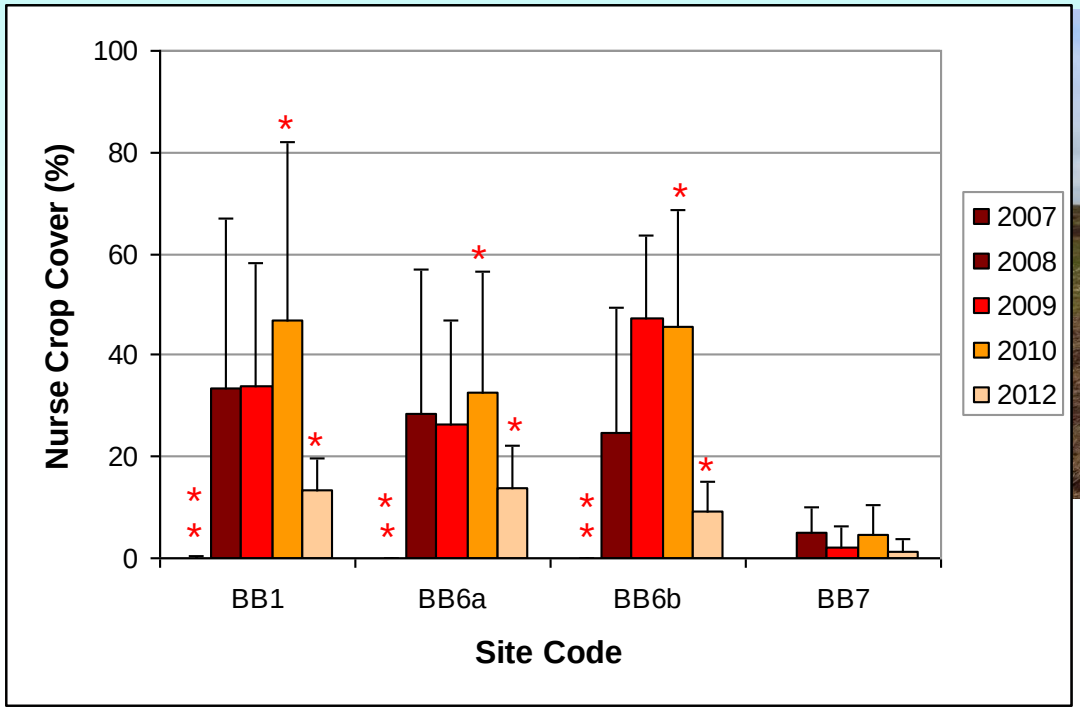
Cover before (2007) and after restoration

BB1 and BB5, gently sloping, treated with lime, fertiliser and grass seed

BB6a and BB6b on steeper slopes treated with lime, fertiliser, grass seed and heather brash

BB6b with geojute as well

BB7 reference site untreated



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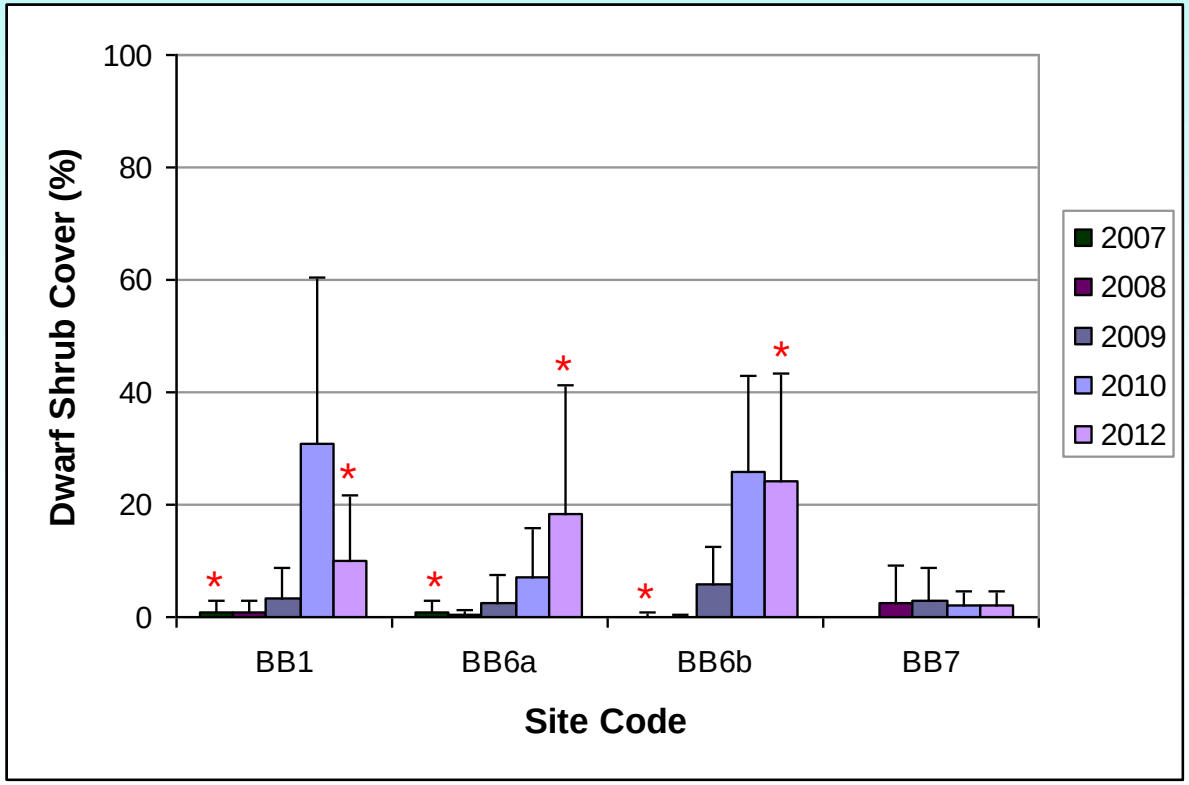
Longdendale – dwarf shrub cover

before (2007) and after restoration

BB1 gently sloping, treated with lime, fertiliser and grass seed
BB6a and BB6b on steeper slopes treated with lime, fertiliser, grass seed and heather brash
BB6b with geojute as well
BB7 reference site untreated

Mostly heather



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Longdendale – Moss cover

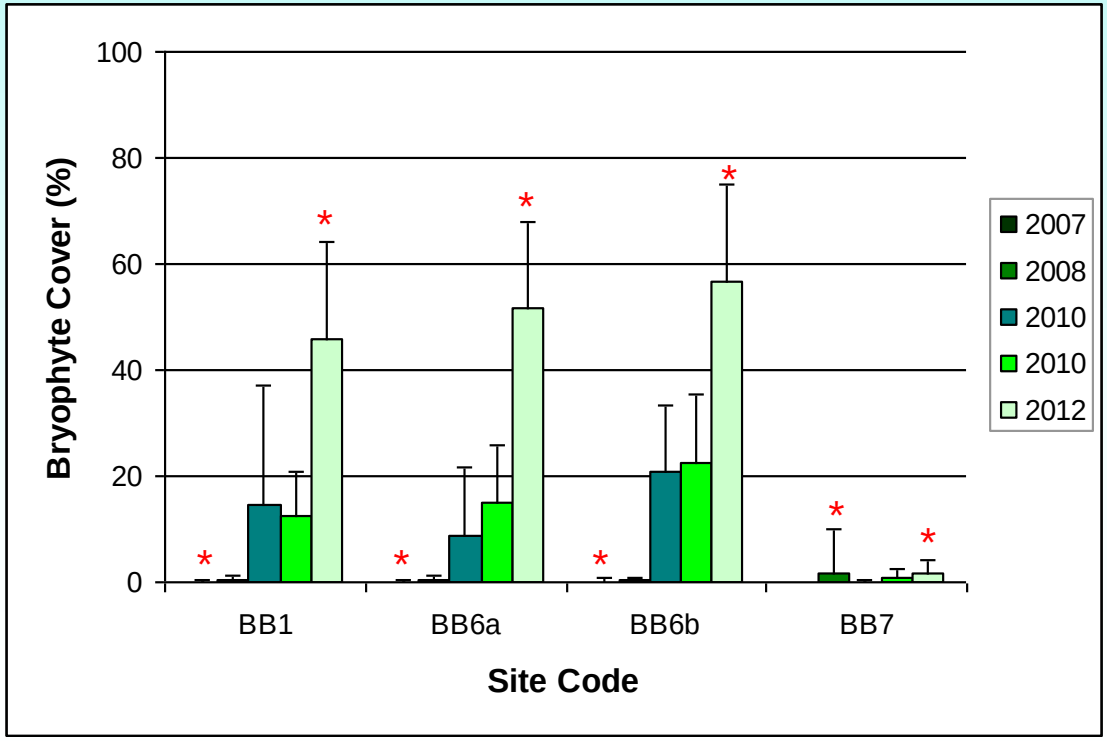
Before (2007) and after Restoration

BB1 gently sloping, treated with lime, fertiliser and grass seed

BB6a and BB6b on steeper slopes treated with lime, fertiliser grass seed and heather brash

BB6b with geojute as well

BB7 reference site untreated



Spp- *Campylopus* & *Hypnum*

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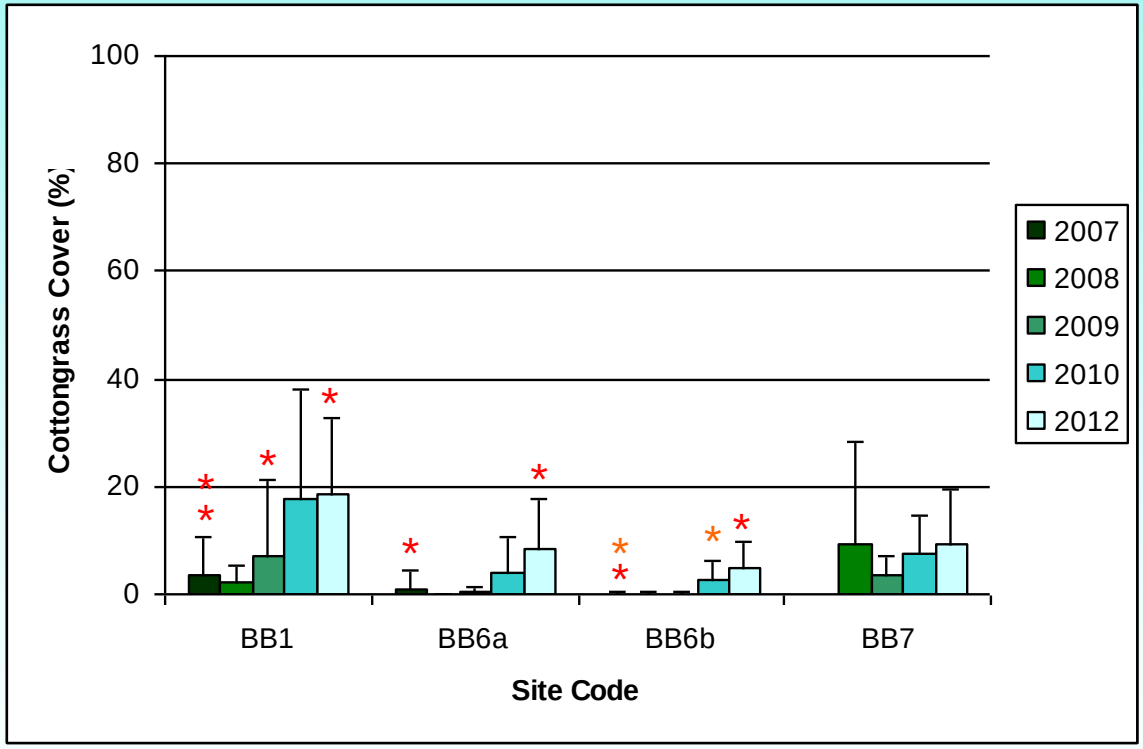
Longdendale - other species

Cottongrasses



No Sphagnum
Few other species

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Coir rolls in peat pans

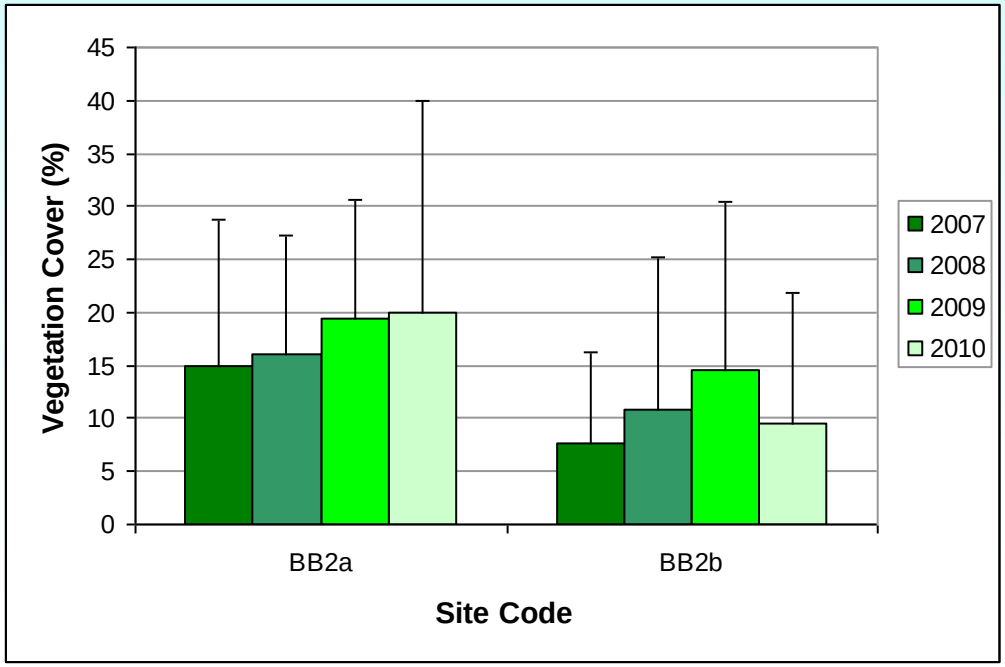
2010

2011

Total Vegetation Cover Baseline Year (2007) and following Restoration Measures (2007onwards)

Plot BB2a no coir

Plot BB2b coir rolls Installed



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Wider works

Stone dams

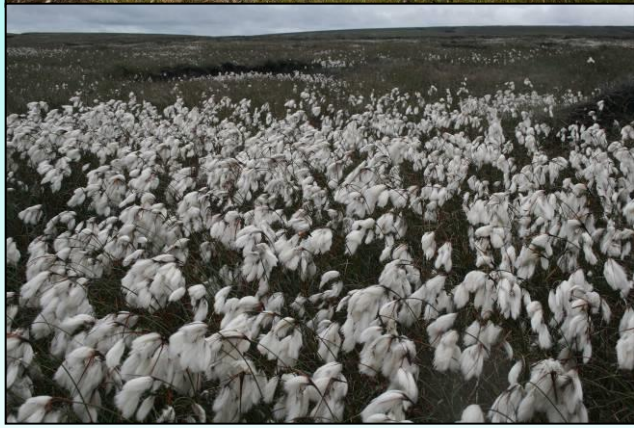
Liming and fertilising

Heather/coir dams

Heather bales

Cottongrass fruiting – stock removal

Coir rolls

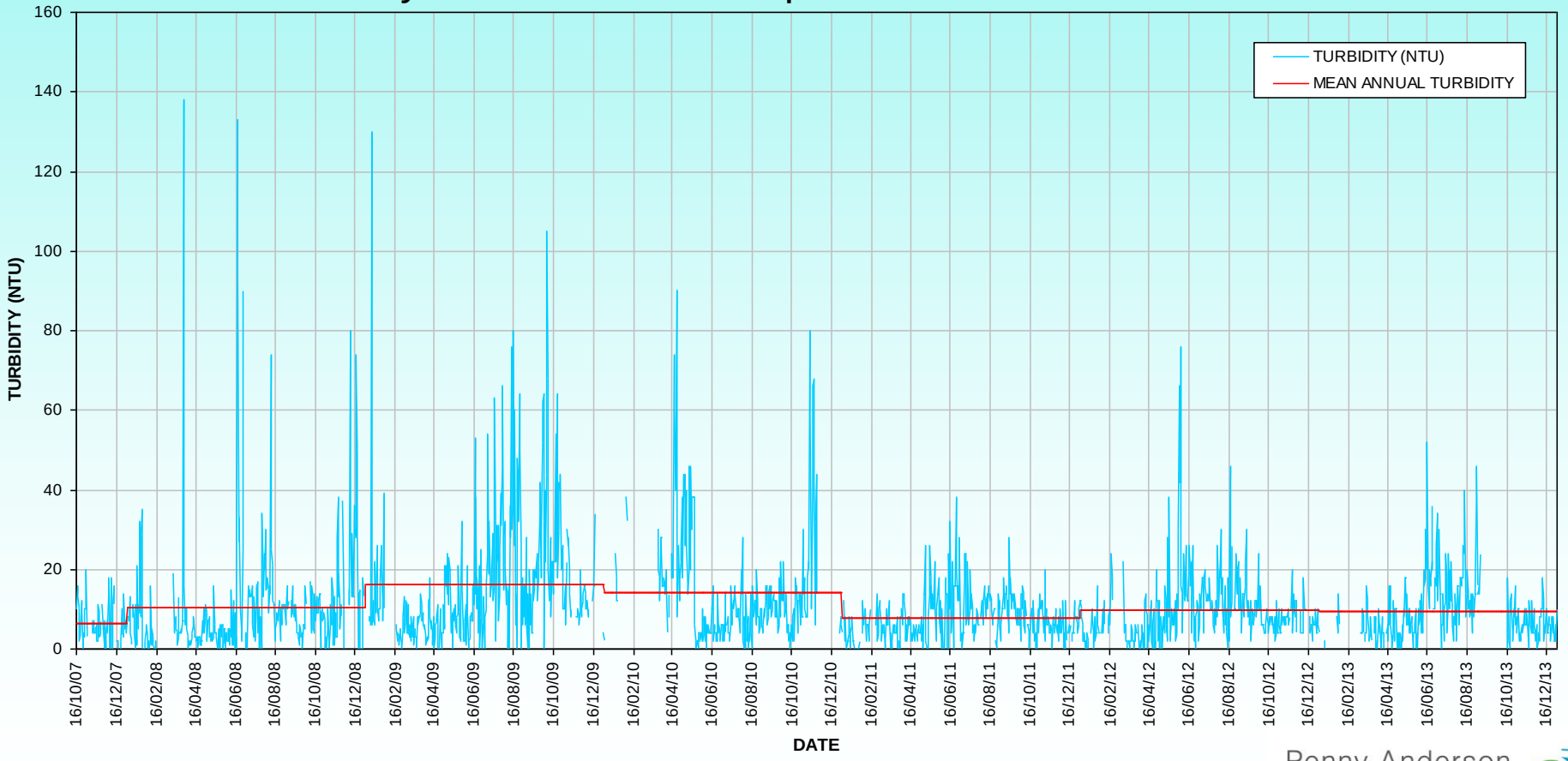


Stone dams in gullies

Turbidity Ashway Gap

Chew Stream sub-catchment

Works 2007-8 early reduction, reduced peaks



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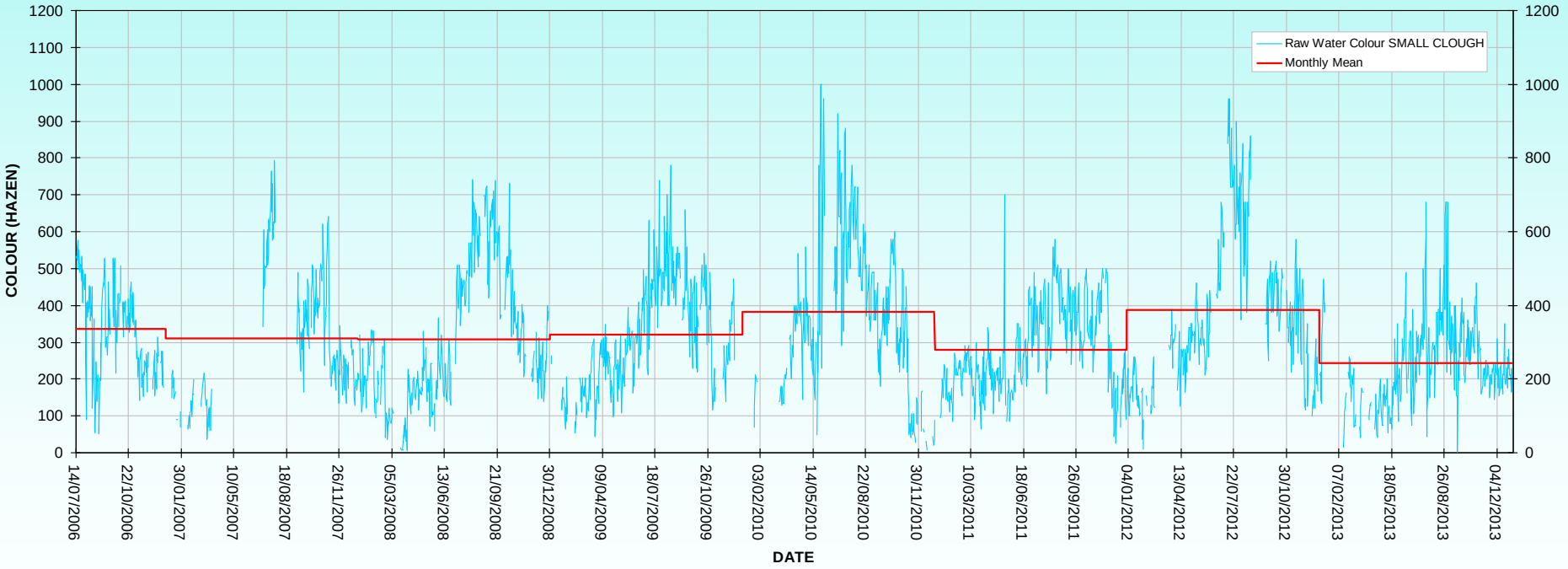
Water quality DOC Small Clough, Ashway Gap

Stable or increasing till 2010, sig. reduction 2010 onwards except 2012 wet summer



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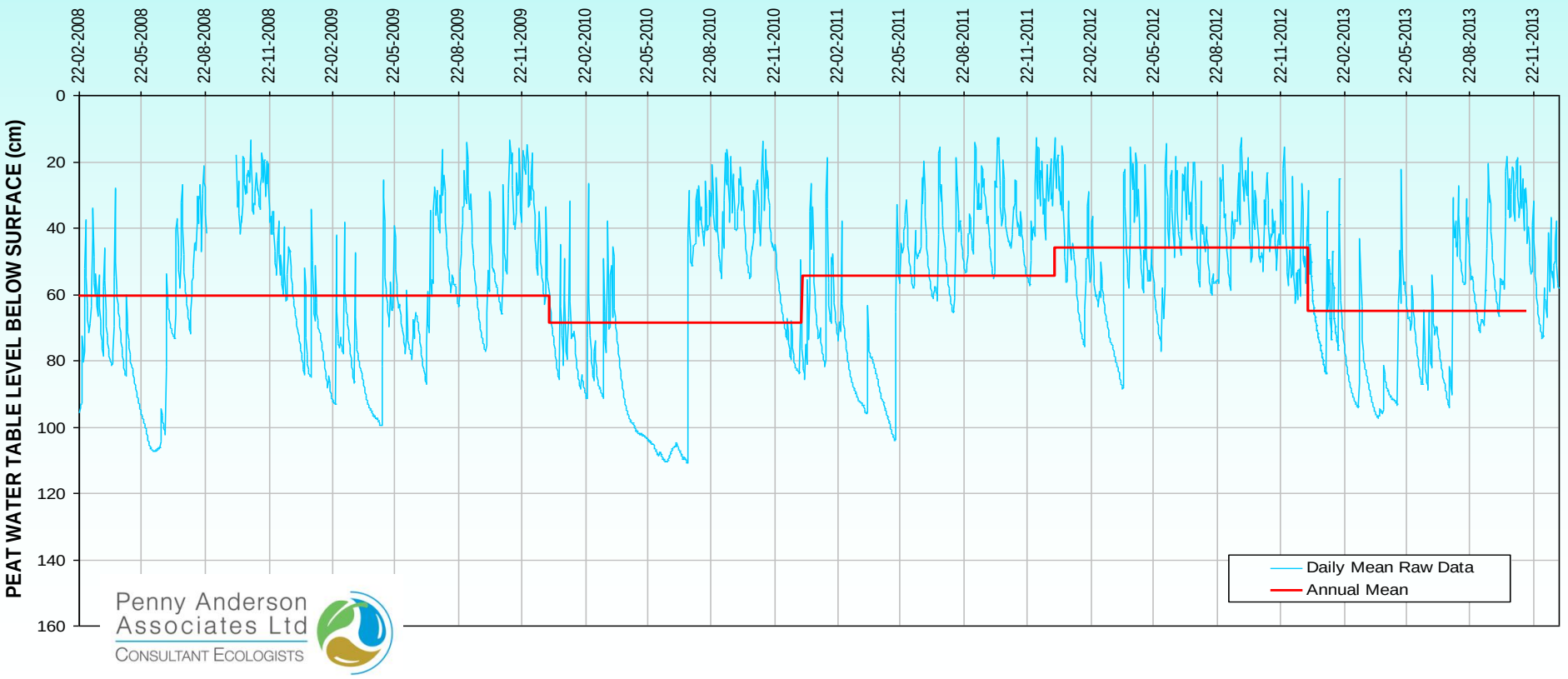
Ashway Gap Blindstones Moss Dipwell - Mean Daily Peat Water Table Depth

Statistically significant rise
mean 80.02cm depth (SD 18.82cm) during the treatment phase, mean 55.95 cm depth SD 25.20cm) post-treatment up to the end of 2009 ($P < 0.001$, $n = 584$)
(Seasonal Kendall Test for monotonic trend)
standard deviation corresponding decrease, variability of groundwater level decreasing



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Conclusions

- Met Government's SSSI targets 2010

  SSSI units enhanced and recovering

- Water quality, particularly water colour

  Reduced colour with grip blocking (and re-vegetation), reduced POC with revegetation, reduced pathogen with stream management

- Reduce runoff rates, sediment load and downstream flooding

  Reduced sediment load after re-vegetation, reduced losses of carbon, runoff rates and downstream flooding – jury out

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