Restoration Trajectories

IUCN | National Committee United Kingdom

Peatland Programme

IUCN Peatland Conference – Beyond Restoration: October 2023

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NIEA
DAERA

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__Sustainability__ at the heart of a living, working, active landscape valued by everyone.

NIEA Northern Ireland Environment Agency
www.daera-ni.gov.uk

An Agency within the Department of Agriculture, Environment and Rural Affairs
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Peatland restoration Northern Ireland

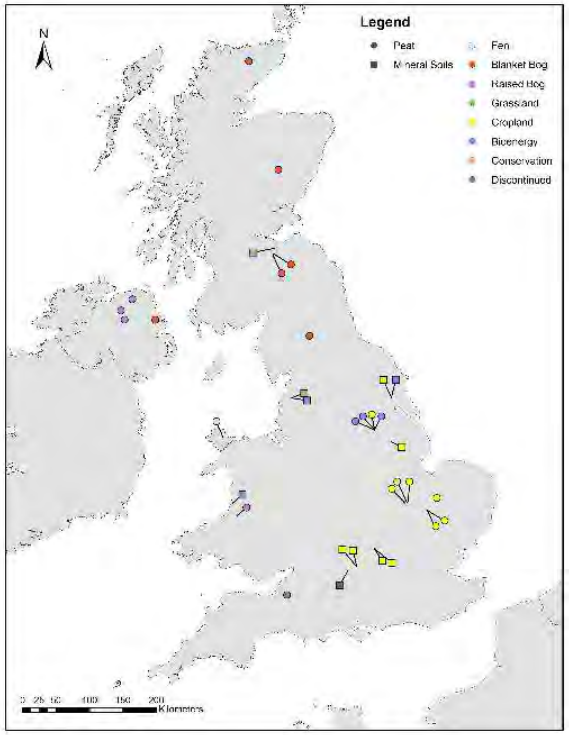
Report: Implementation of an Emissions Inventory for UK Peatlands – **2017 NI total peat extent of 242,622ha** (8% of UK Peatlands)

James Hutton Institute Peat Mapping project – **2023 NI total peat extent of 310,031ha**

Climate Change Committee target – 150,000 ha restored by 2050 (NI peatlands equate to 10% of the UK total)

PeatFlux: a national carbon flux network for peatlands in Northern Ireland

Figure 1- UKCEH Flux tower network



CEH DAERA Environment Fund Challenge fund project ,

- Glenullin, Ulster Wildlife site– Raised bog
- Ballynahone SAC – Raised Bog
- Garry Bog SAC– Raised Bog
- Glenwherry Hill Farm – Blanket bog

The PeatFlux network is integrated with the UKCEH Land Flux Network, contributing to assessments of the status of the carbon, water and GHG balance of UK peatlands.

Carbon (CO2, CH4) flux observations at Northern Ireland peatlands - CEH Report March 2023

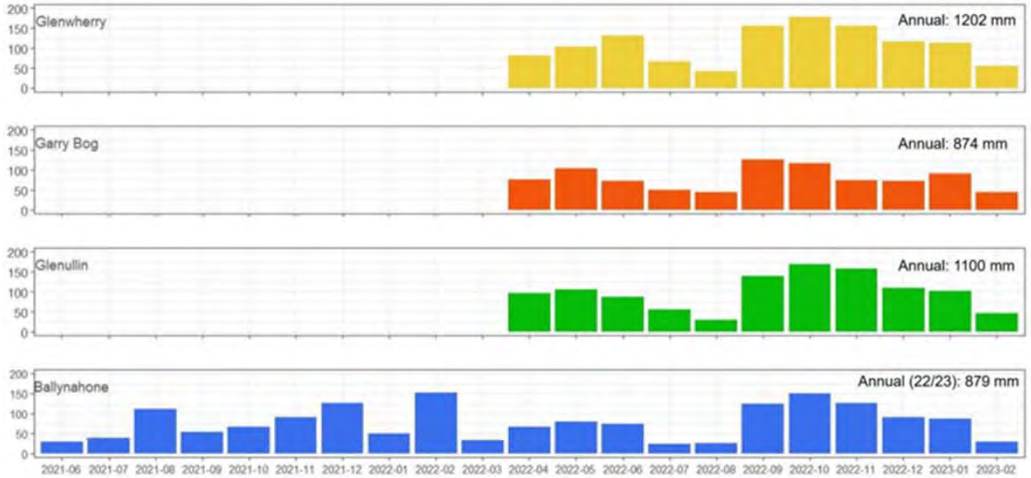


Figure 3. Total monthly precipitation for all sites.

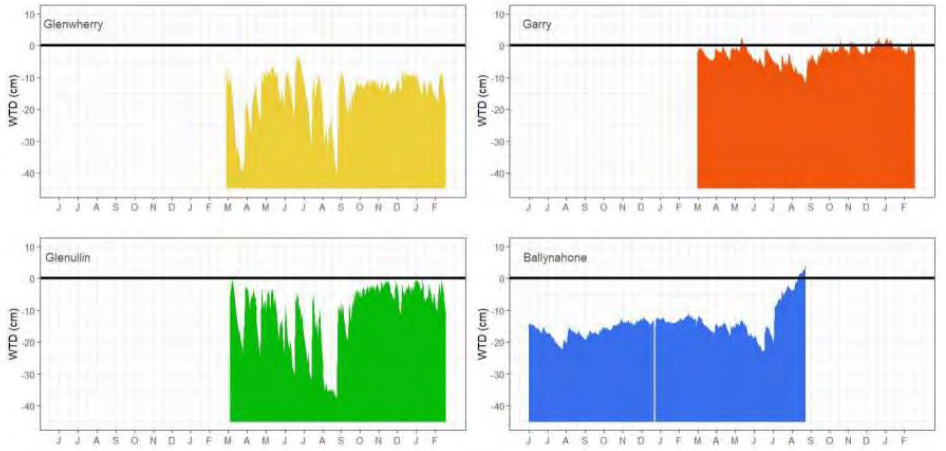


Figure 4. Average daily water table depth for all sites. The solid black line denotes the soil surface.

Carbon (CO2, CH4) flux observations at Northern Ireland peatlands - CEH Report March 2023

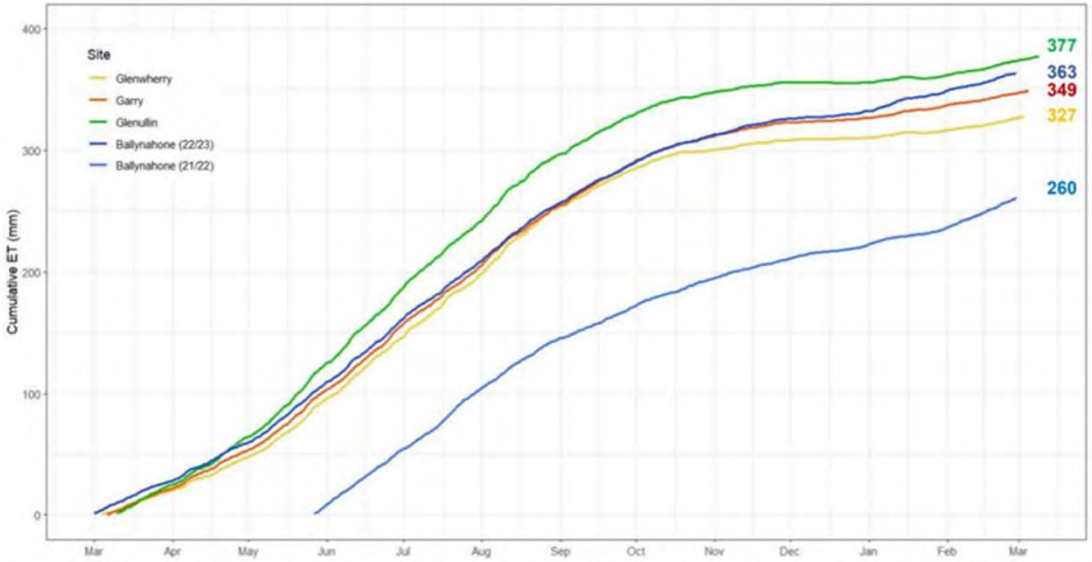


Figure 13. Cumulative evapotranspiration at all sites. Note: Ballynahone (21/22) is an incomplete year as it was installed in June (light blue line).

Glenullin observed the highest ET rates and Glenwherry the lowest.

High availability of water at Glenullin and,

Graminoid dominant vegetation and soil with a low hydraulic conductivity at Glenwherry.

Carbon (CO2, CH4) flux observations at Northern Ireland peatlands - CEH Report March 2023

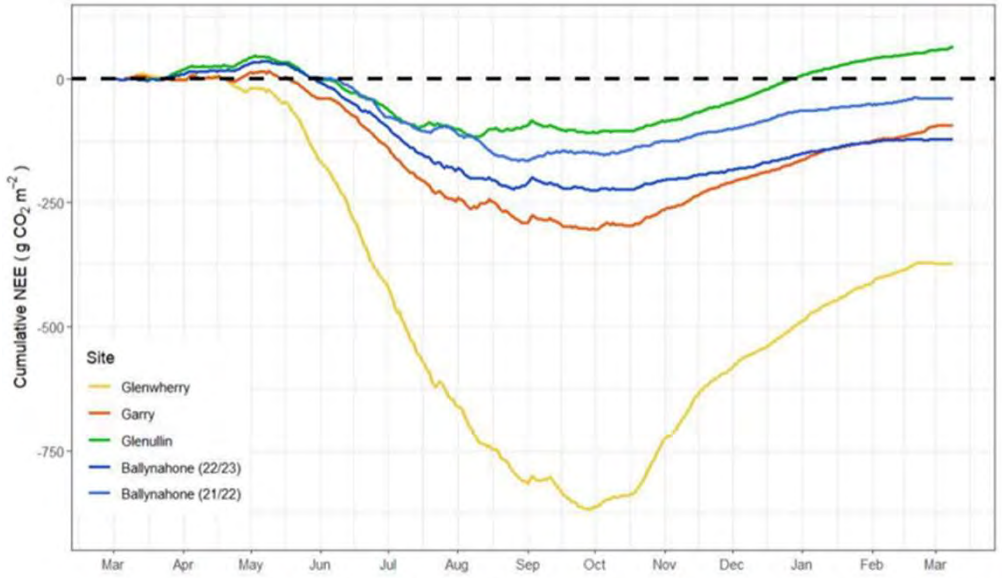


Figure 8. Cumulative NEE (gCO_2 m^{-2}) for all sites from March 2022 to March 2023

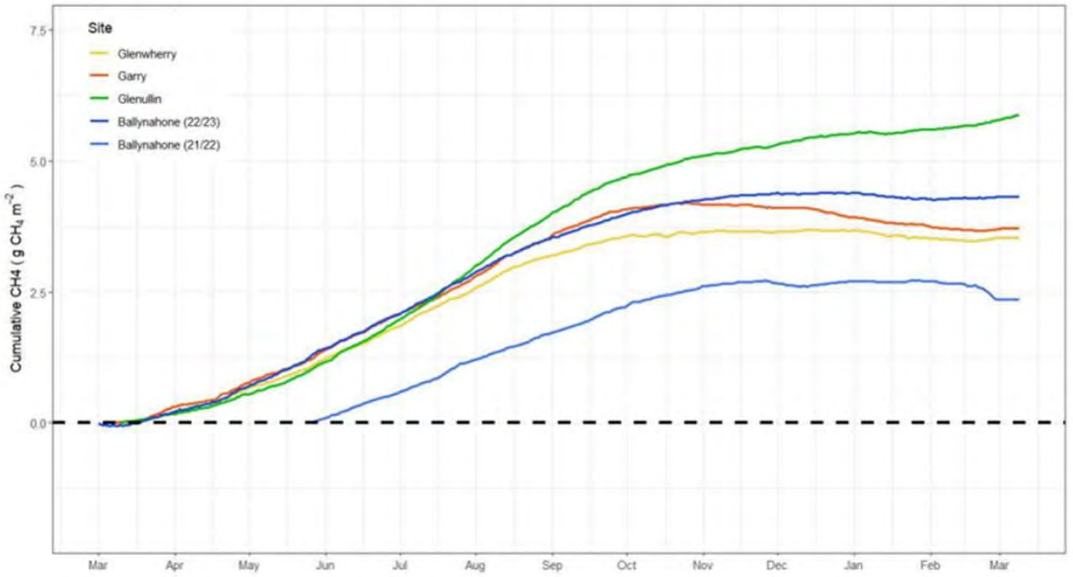


Figure 10. Cumulative C-CH_4 emissions from all sites. Negative values denote CH_4 uptake. Please note there is an incomplete year of data for Ballynahone 2021/2022 as the site was installed in June (light blue line).

Carbon (CO2, CH4) flux observations at Northern Ireland peatlands - CEH Report March 2023

Table 2. Annual NEE, CH_4 and the CH_4-CO_2 equivalent (CO_2e) all sites. CO_2e was calculated based on a 20-year and 100-year Global Warming Potential (GWP) of 85.5 and 32, respectively. Negative values denote uptake.

Site	Dates	NEE	CH4	CH4 (CO_2e) 20yr	CH4 (CO_2e) 100yr
		$gCO_2\ m^{-2}\ yr^{-1}$	$gCH_4\ m^{-2}\ yr^{-1}$	$gCO_2e\ m^{-2}\ yr^{-1}$	$gCO_2e\ m^{-2}\ yr^{-1}$
Glenwherry	04-03-2022 to 03-03-2023	-372	3.53	302	113
Garry Bog	06-03-2022 to 05-03-2023	-93	3.72	318	119
Glenullin	10-03-2022 to 09-03-2023	66	5.88	503	188
Ballynahone	01-03-2022 to 28-02-2023	-118	4.39	375	141

Glenwherry sequestered the largest amount of carbon dioxide and had the lowest methane emissions.

When converted to CO2e, Garry Bog, Glenullin and Ballynahone all become a net source of CO2e at annual scale.

Issues

- Dependence on CEH technical expertise

- Issues with stability and operation of equipment

- Staff resource for routine maintenance

Next steps

- Continue the measurements at these four flux towers

- Expand the NI network to represent the range of Peatland Condition categories

- Develop a NI technical base and competencies for undertaking these monitoring

End

For further information:

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Peatland Projects at CAFRE 2023

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College of Agriculture, Food & Rural Enterprise

Maximising hill farm outputs.

CAFRE Audience;

1600 students
3000 Business Development Group members
Visiting farmer groups
Assistance to policy
Press - Agri journalists

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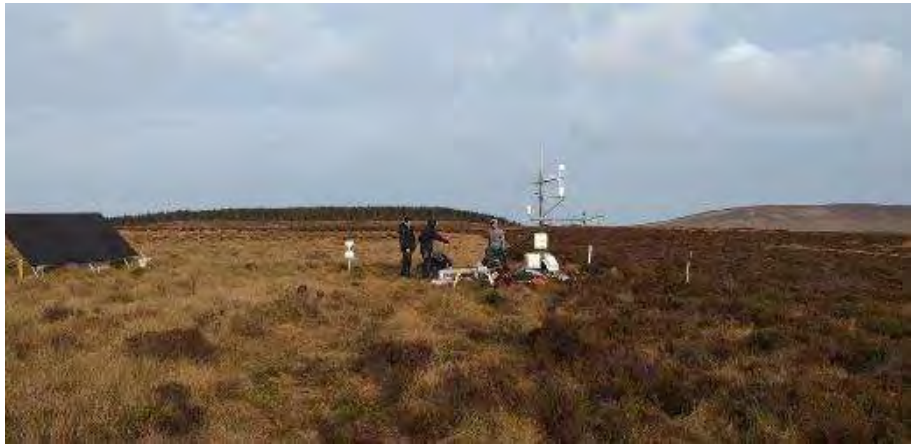
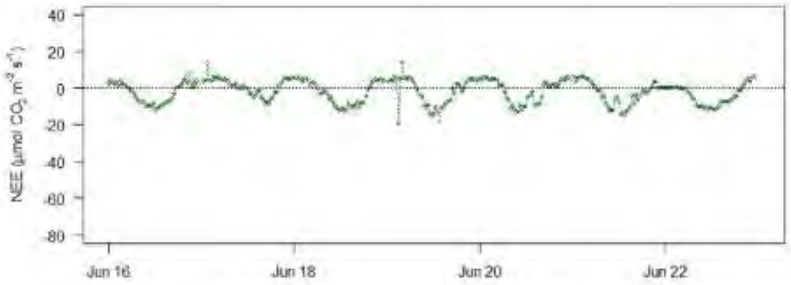
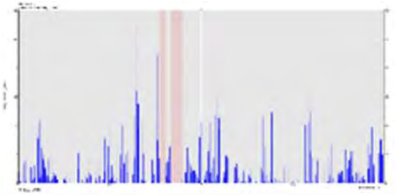
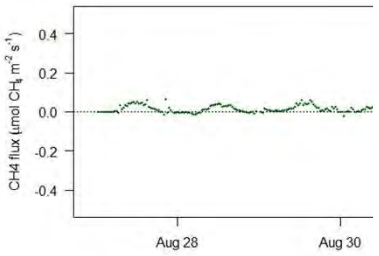
GHG Flux data (CEH) from March 2022

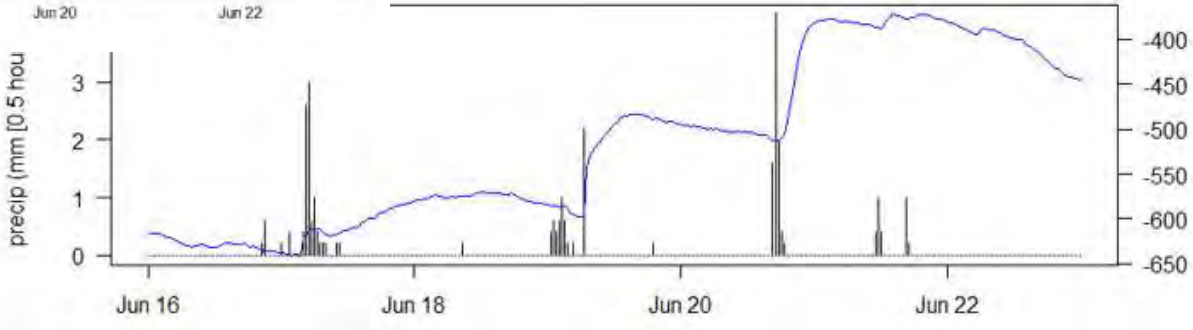




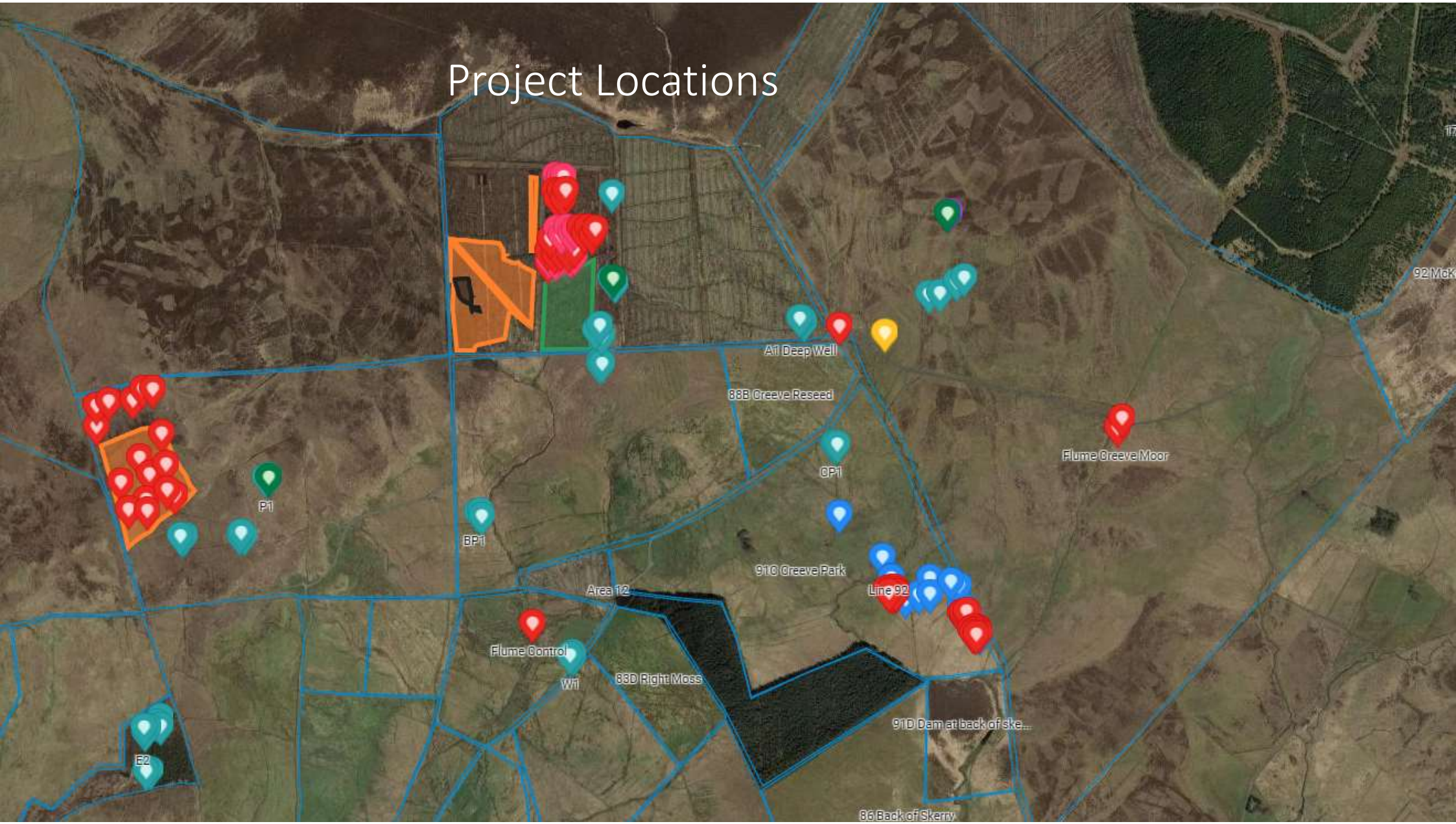
COSMOS Weather Data (CEH)







Project Locations



Fluvial Carbon & Catchment Hydrology

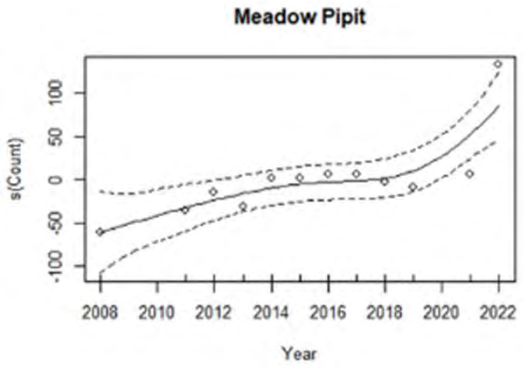
Jan 2020 – QUB MSc & undergrads projects DOC & flow rate comparison between Forest (to Bog) & Creeve Moor– “relatively” intact moor treatment cost Nov 2021 ~ £90/ha/yr v £18/ha/yr

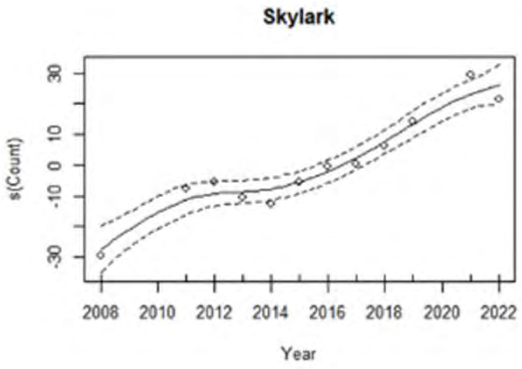
March 2023 – Ulster University PhD - Three sub catchments – flumes installed - fully automated fluvial C & levels for flow rate.

Hill Biodiversity Output

Irish Grouse Conservation Trust

Glenwherry Hill Regeneration Partnership (GHRP 2009 – 2022)





Waders

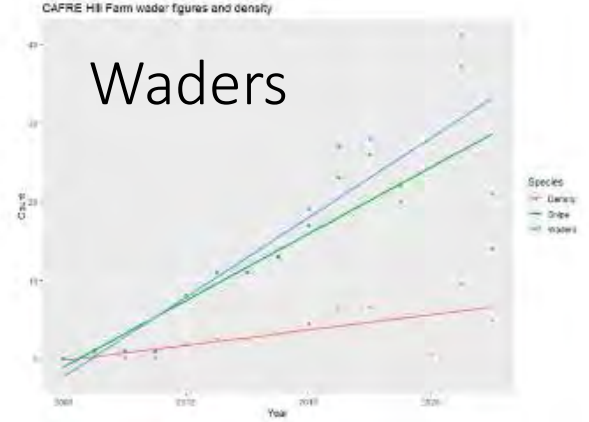
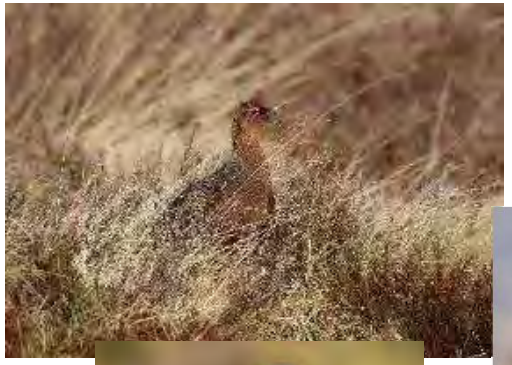
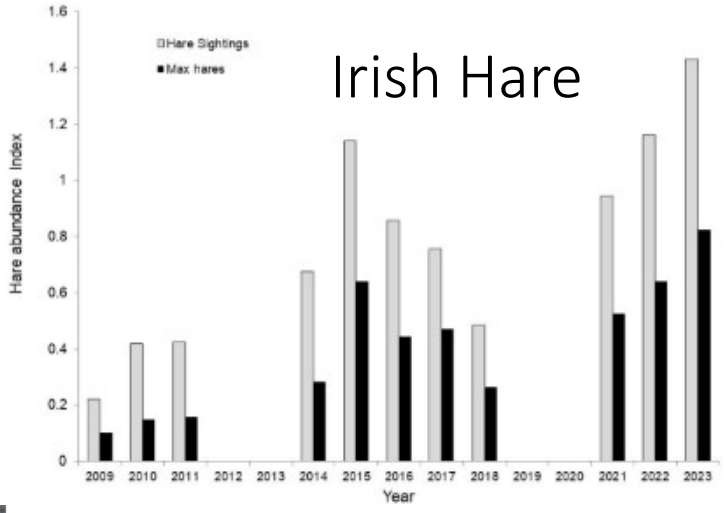


Figure 6 Breeding wader figures of the CAFRE hill for 2008 -2022 (no data for 2020). Density (coral) of waders is worked out from the 423ha area surveyed. Total wader numbers (blue) include all three species: curlew, lapwing, and snipe. Snipe figures individually shown in green.

- Annual Surveys from 2009
Red Grouse, Irish Hare
Breeding Wader,
Hen Harrier & Merlin,
Pipits & Skylark,

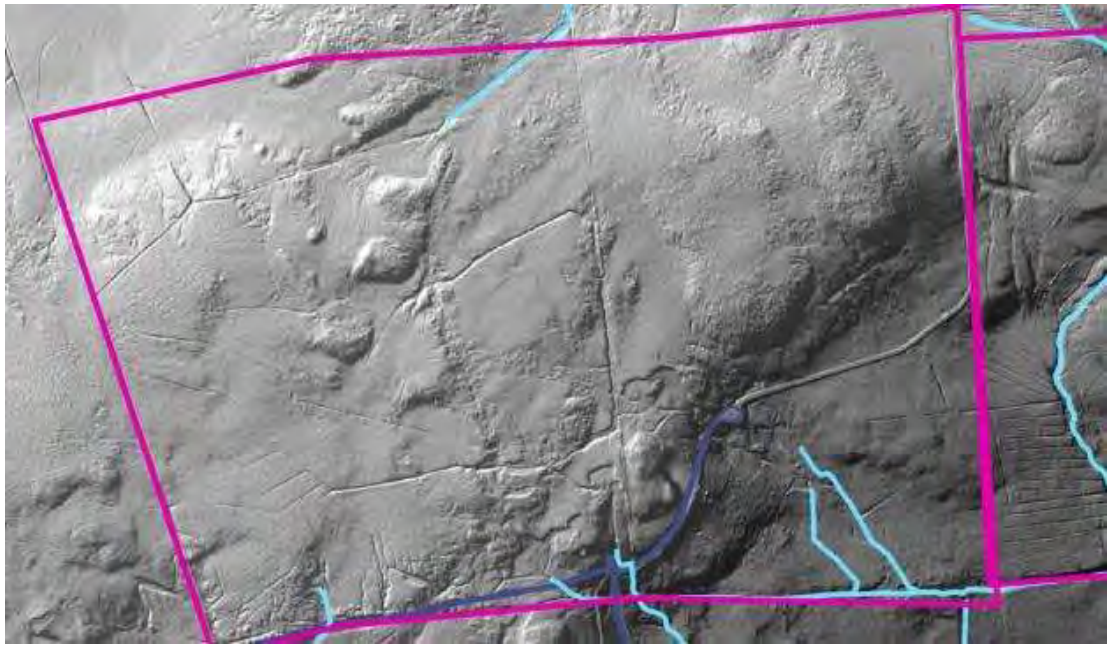


Irish Hare



What was the plan before the flux tower?
a. Drain blocking

Achieving Full Ecosystem Services on Peatland
– CASE STUDY - Front Point 50ha's @ CAFRE Hill Farm



What proportion to amend?

Variation within 1 site

Variation BETWEEN sites

Minor V Main drains ???

Within 12ha's ~ 6.6km of drains with over 700 interventions

What was the plan before the flux tower?

a. Drain blocking b. peat pipe interventions

April 2021 Creeve Moor – WTD, Water Quality, Multiple water sites for birds

Next Steps for Creeve flux tower site

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- Continued data collection for;
- full C balance & catchment hydrology
- 2 x PhDs Sept 2023 Ecotope GHG flux using portable equipment
- Eventual drain blocking & pipe intervention with before, during & after data collection

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CAFRE HILL FARM OUTPUTS

Livestock
Biodiversity
(1. the site
2. As a Nature Recovery Area to spill over)
Water Quality
Flood Alleviation
Water Resource
Carbon Storage
Wildfire Prevention
Carbon Sequestration

Activities

Education
Technology
Demonstration
Monitoring &
Research site

Environmental Measurements

- Wader, passerine, grouse, raptor, hare counts.
- Water Quality
- Flow discharge
- Carbon fluvial losses
- GHG Flux
- WTD
- Vege analysis – PAC
- COSMOS Weather station

Research Partners
QUB, UU, Afbi, CEH

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Peatland restoration:

Biodiversity responses

Richard Lindsay, Sustainability Research Institute

M4 Carex rostrata-Sphagnum recurvum mire

M5 Carex rostrata-Sphagnum squarrosum mire

M6 Carex echinata-Sphagnum recurvum/auriculatum mire

M7 Carex curta-Sphagnum russowii mire

M8 Carex rostrata-Sphagnum warnstorfii mire

M9 Carex rostrata-Calliergon cuspidatum mire

M10 Carex dioica-Pinguicula vulgaris mire

M11 Carex demissa-Saxifraga aizoides mire

M12 Carex saxatilis mire

M13 Schoenus nigricans-Juncus subnodulosus mire

M14 Schoenus nigricans-Narthecium ossifragum mire

M15 Scirpus cespitosus-Erica tetralix wet heath

M16 Erica tetralix-Sphagnum compactum wet heath

M21 Narthecium ossifragum-Sphagnum papillosum valley mire

M22 Juncus subnodulosus-Cirsium palustre fen meadow

M23 Juncus effusus/acutiflorus-Galium palustre rush pasture

M24 Molinia caerulea-Cirsium dissectum fen meadow

M25 Molinia caerulea-Potentilla erecta mire

M26 Molinia caerulea-Crepis paludosa mire

M27 Filipendula ulmaria-Angleica sylvestris mire

M28 Iris pseudacorus-Filipendula ulmaria mire

M29 Hypericum elodes-Potamogeton polygonifolius soakway

M30 Hydrocotylo-Baldellion seasonally inundated habitats

M31 Anthelia julacea-Sphagnum auriculatum spring

M32 Philonotis fontana-Saxifraga stellaris spring

M33 Pholia wahlenbergii var. glacialis spring

M34 Carex demissa-Koenigia islandica flush

M35 Ranunculus omiophyllus-Montia fontana rill

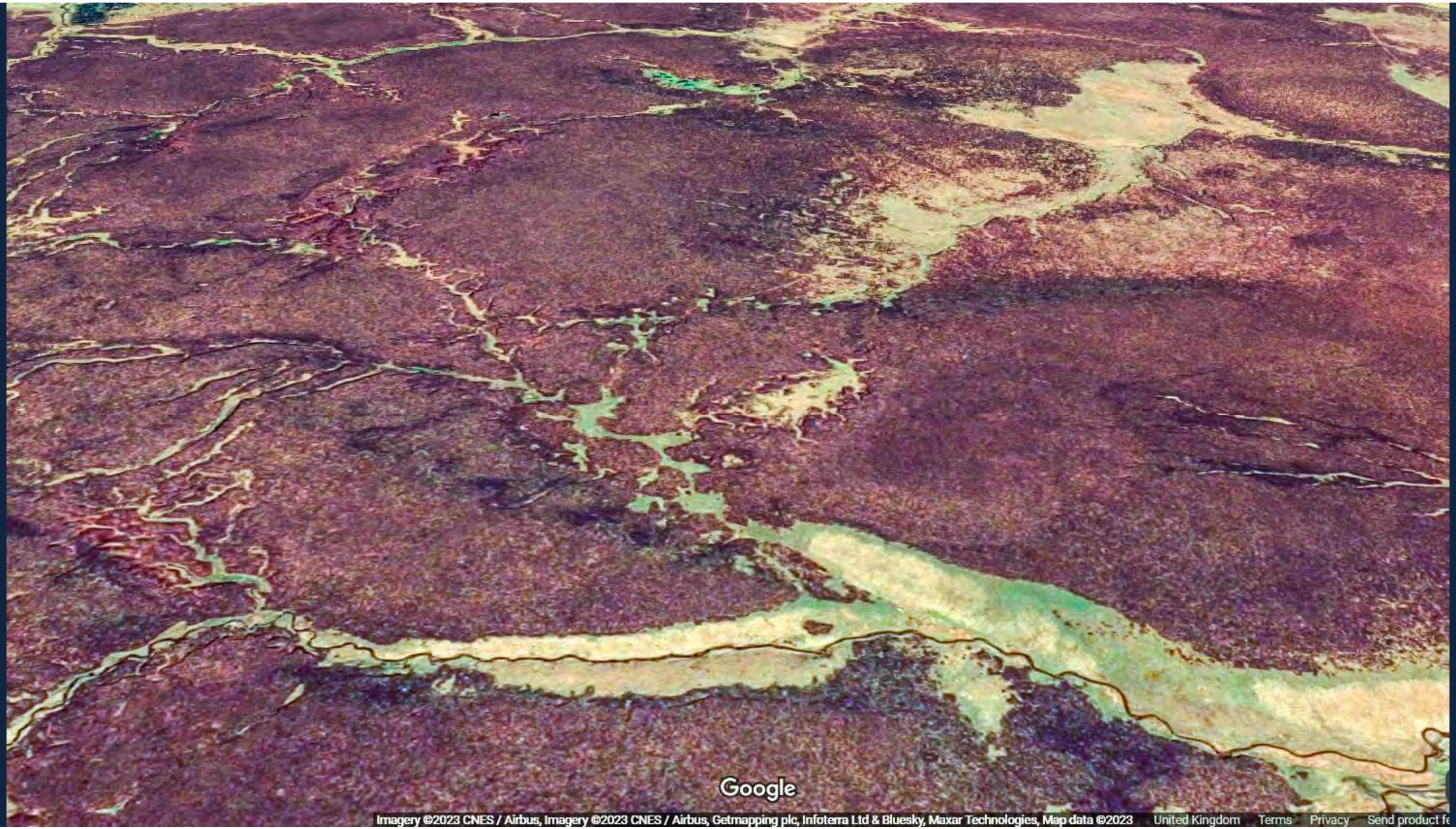
M36 Lowland springs and shaded streambanks

M37 Cratoneuron commutatum-Festuca rubra spring

M38 Cratoneuron commutatum-Carex nigra spring

PLUS

28 swamp and tall-herb fen communities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Favourable Conservation Status

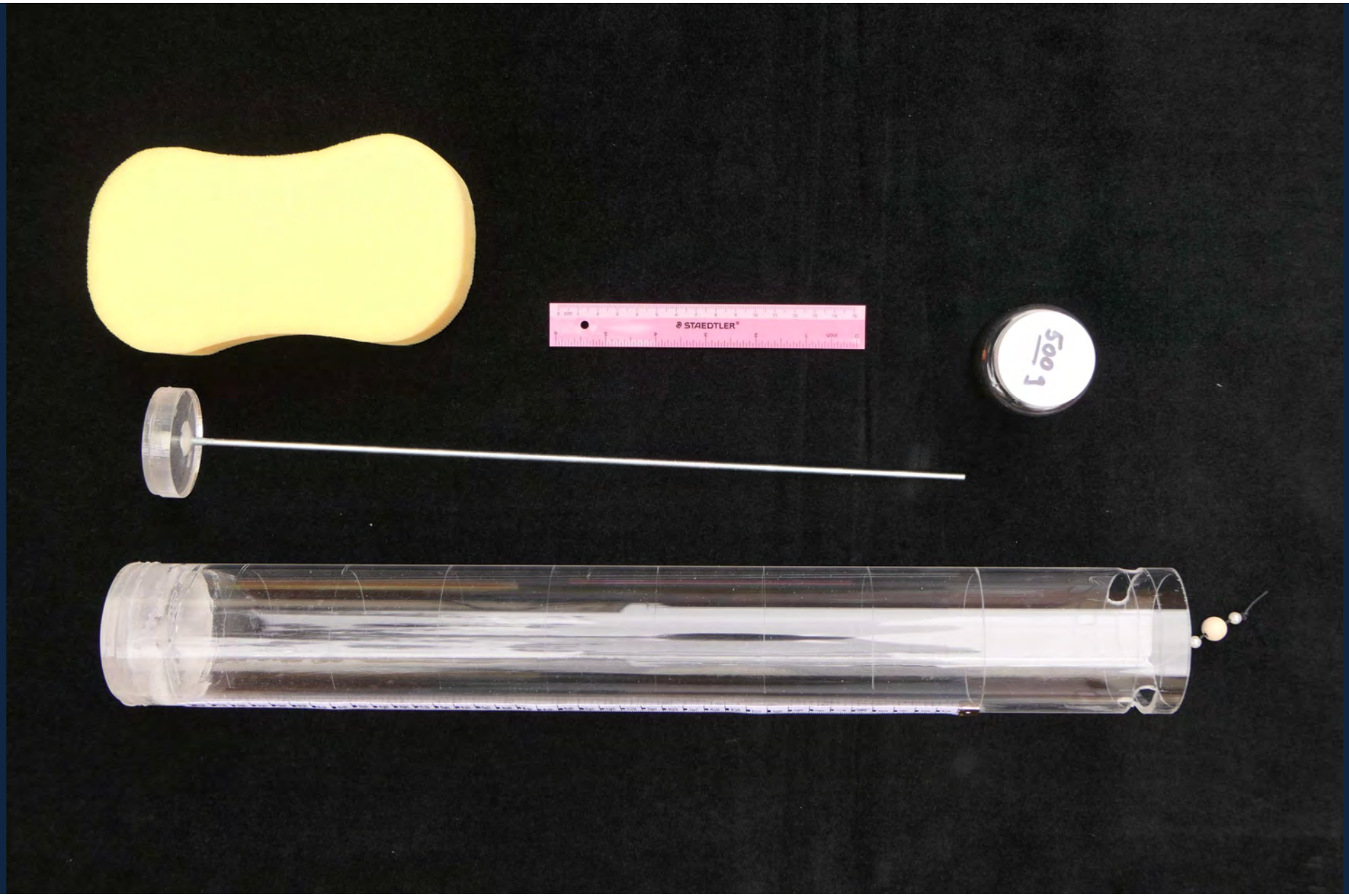
…all the structure and function necessary for the long-term maintenance of the interest is in place and likely to remain in place for the foreseeable future.


Photo: Iain Diack

Mire pattern no:……Site:…	Peat depth	Date	Time (to link photos)	Recorder	Notes:…

Zone (relation to w/t)	DFR (321) Freq.	Vegetation types: Terrestrial zones				Primary (original) / Secondary (cut-over) surface (circle relevant condition)					Extra veg types	
		Relatively 'active', likely to be favourable condition……>>				<<. Degraded, some recovery…>>		<<. …Degraded, Unfavourable……>>				
T5 (peat mound) found only in far north & west of Scotland (1 m+)		Sphagnum/ dwarf shrubs	'Feather' mosses	Calluna/Empetrum	Racomitrium	°Cladonia/bare peat	°	Collapse features°	Extensive bare peat°	°		
T4 (erosion complex hagg top) (50 cm+)		Sphagnum mosses		Hypnoid mosses	Mixed dwarf shrub/ hypnoid moss	Calluna/hypnoid moss cover	Racomitrium	Mixed dwarf shrubs/ no moss	Calluna/ no moss	Bare peat/ lichens		
						Molinia/hypnoid moss cover	Racomitrium/Molinia		Bare peat/dwarf shrubs	Molinia/ bare peat		
T3 (hummock) (30 cm-50 cm)		Sphagnum		Racomitrium (in far W Scotland)		Hypnoid mosses	Polytrichum commune	Racomitrium (elsewhere)	Lichens dominant	Bare peat		
		Sphagnum fuscum	Sphagnum papillosum	Sphagnum austinii [imbricatum]	Sphagnum capillifolium	Sphagnum subnitens	Hypnoid/Poly trichum mosses	Leucobryum	Short mosses/bare peat	Dwarf shrubs/ no moss		
		Sphagnum magellanicum	Sphagnum/ Eriophorum	Sphagnum/ Molinia	Dwarf shrubs over Sphagnum	Dwarf shrubs/ hypnoid mosses		Hypnoid mosses/ lichens				
Tk (tussock) (hard unyielding feature obvious underfoot		Schoenus nigricans (only in far W of Scotland)	Sphagnum over Eriophorum vaginatum tussock°	Sphagnum over Molinia tussock	Sphagnum over Trichophorum tussock	Eriophorum vaginatum with some Sphagnum	Molinia with some Sphagnum	Molinia caerulea	Eriophorum vaginatum	Trichophorum cespitosum		
							Trichophorum with some Sphagnum	Deschampsia flexuosa				
T2 (high ridge) (15 cm-30 cm)		Sphagnum				Hypnoid mosses	Eriophorum vaginatum	Dwarf shrubs/ no moss	Lichens dominant	Bare peat		
		Sphagnum/ Rubus chamaemorus	Sphagnum/Erica tetralix	Sphagnum magellanicum	Sphagnum/ Eriophorum	Calluna with some Sphagnum	Dwarf shrubs/ hypnoid mosses	Eriophorum vaginatum/ no moss	Bare peat/ dwarf shrubs			
		Sphagnum papillosum	Sphagnum capillifolium	Sphagnum/ Molinia	Sphagnum/ dwarf shrubs	Sphagnum subnitens	Hypnoid/Poly trichum mosses	Sphagnum compactum	Bare peat/ Trichophorum			
		Sphagnum fuscum	Sphagnum austinii [imbricatum]									
T1 (low ridge) (1 cm-15 cm) If S. capillifolium is dominant at this level it suggests drying		Sphagnum (not S. fallax)				Hypnoid mosses	Eriophorum vaginatum	Dwarf shrubs/ no moss	Lichens dominant	Bare peat		
		Sphagnum papillosum	Sphagnum magellanicum	Sphagnum/ dwarf shrubs	Campylopus atrovirens (in W Scotland)	Sphagnum capillifolium dominant	Sphagnum tenellum dominant	Dwarf shrubs/ hypnoid mosses	Bare peat/ dwarf shrubs			
		Sphagnum/Erica tetralix	Sphagnum/ Eriophorum	Sphagnum/ Drosera		S. fallax			Bare peat/ Trichophorum			
T1/A1 (0 cm-5 cm) edges of pools/ hollows, or 'runnels'		Sphagnum pulchrum	Sphagnum tenellum	Aulacomnium palustre	Narthecium ossifragum	Sphagnum fallax	°	Sphagnum compactum	°Bare peat/ Trichophorum	Bare peat		
		Drosera anglica	Rhynchospora									

Mire pattern no:..... Site:											Peat depth:	Date:	Recorder:	Primary (original) / Secondary (cut-over) surface (circle relevant condition)	
Zone (relation to w/t)	DFR (321) Freq.	**Vegetation types** Relatively 'active', likely to be favourable condition .....>> <<Degraded, some recovery...>><< ....Degraded, Unfavourable.....>>												**Extra veg types**	
T5 (peat mound) (2 m+)		Sphagnum capillifolium/ dwarf shrubs	Feather' mosses	Calluna/Empetrum	Racomitrium										
T4 (hagg top) (1 m+)				Hypnoid mosses	Mixed dwarf shrub/Calluna/ hypnoid moss	Calluna/ moss cover	Racomitrium	Dwarf shrubs/ no moss	Calluna/ no moss	Bare peat/dwarf shrubs/Cladonia					
T3 (hummock) (30 cm-1 m)		Sphagnum fuscum	Sphagnum papillosum	Sphagnum austinii [fimbriatum]	Sphagnum capillifolium	Sphagnum subnitens	Hypnoid/Poly-trichum mosses	Racomitrium	Dwarf shrubs/ hypnoid mosses	Dwarf shrubs/ no moss					
Tk (tussock)		Schoenus nigricans				Eriophorum vaginatum		Molinia caerulea	Trichophorum cespitosum	Deschampsia flexuosa					
T2 (high ridge) (15 cm-30 cm)		Sphagnum/high-altitude shrubs	Sphagnum/Erica tetralix	Sphagnum magellanicum	Sphagnum Eriophorum	Sphagnum Calluna	Dwarf shrubs/ hypnoid mosses	Bare peat/ Trichophorum	Bare peat/ dwarf shrubs	Sphagnum compactum					
T1 (low ridge) (1 cm-15 cm)		Sphagnum papillosum	Sphagnum magellanicum	Sphagnum fallax/ tenellum	Campylopus atrovirens				Bare peat/ dwarf shrubs	Bare peat/ Trichophorum					
T1/A1 (0 cm-5 cm)		Sphagnum pulchrum	Sphagnum tenellum	Autacomnium palustre	Narthecium ossifragum			Sphagnum compactum		Bare peat/ Trichophorum					
A1 (Sph. hollow (-10 cm-0 cm)		Sphagnum cuspidatum	S. cuspidatum/ E. angustifolium	Sphagnum recurvum											
A2 ('mud-bottom' hollow) (-5 cm to -20 cm)		Wet/flooded bare peat	Flooded Molinia litter												
A3 (drought-sensitive pool) (-10 cm to -40 cm)		Sphagnum cuspidatum	Sphagnum auriculatum	Menyanthes trifoliata	Eriophorum angustifolium										
A4 (permanent pool) (-50 cm to -6 m)		Menyanthes trifoliata	Sphagnum auriculatum	Sphagnum cuspidatum											
E1 (reveg gully)		Sphagnum papillosum	Sphagnum magellanicum	Sphagnum capillifolium	Sphagnum recurvum	Sphagnum tenellum	Eriophorum angustifolium		Juncus squarrosus						
E2 (eroding gully)										Eroding bare-peat gully					
Em (bare) (micro-erosion										Bare peat					
Em (moss) (micro-erosion)							Hypnoid moss and Sphagnum	Hypnoid moss	Campylopus-type moss						
Em (Sphagnum)						Sphagnum moss									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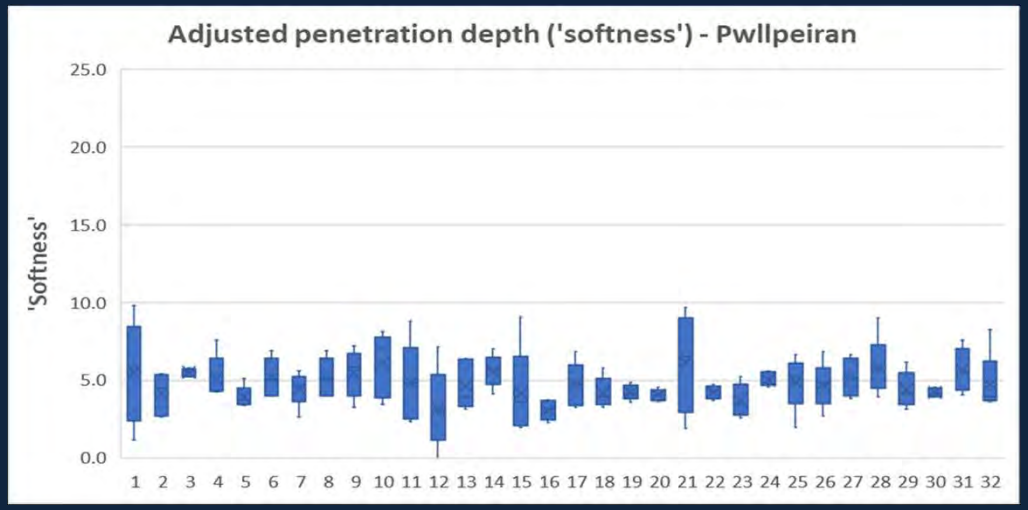
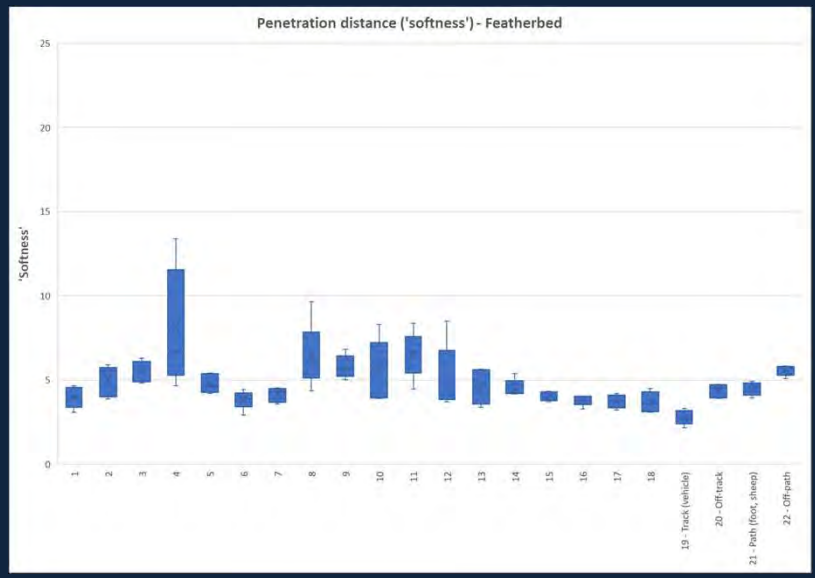
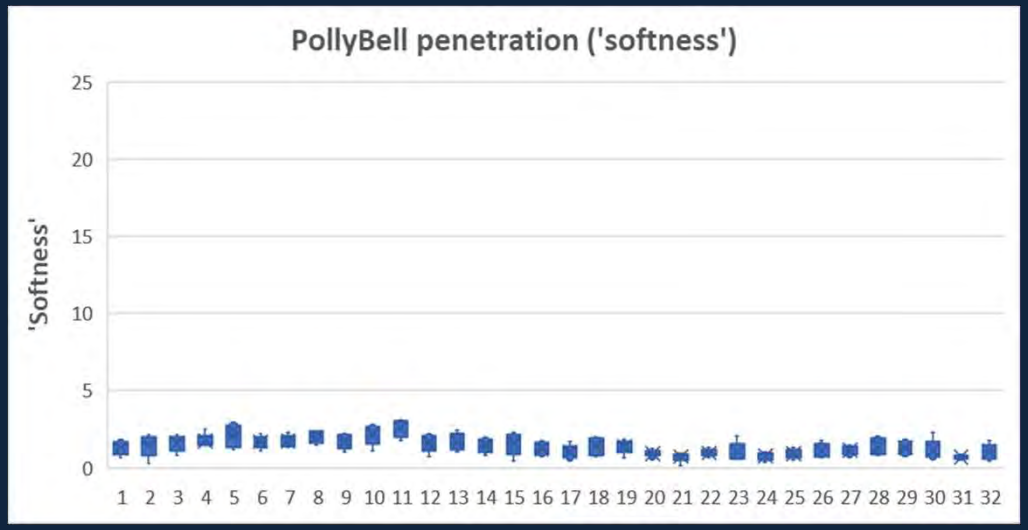
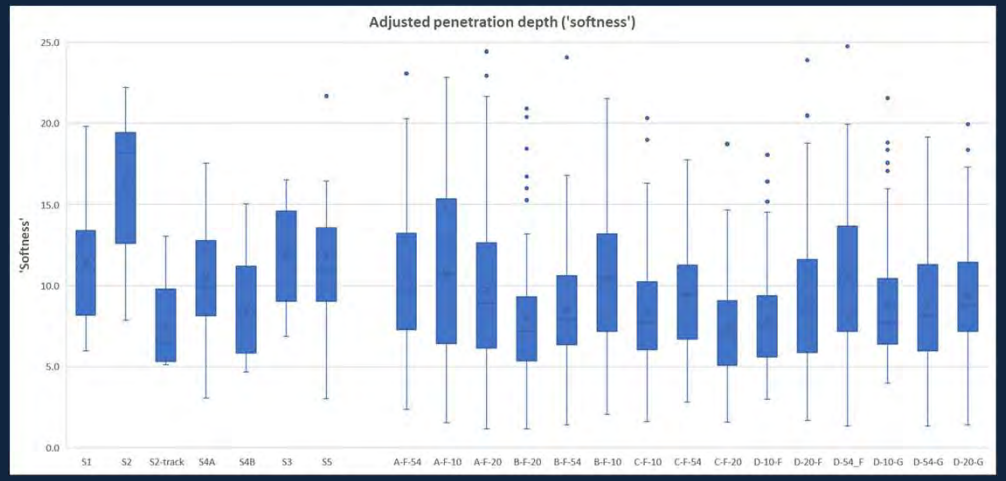

Adjusted penetration depth ('softness') - Pwllpeiran
'Softness'
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32


Penetration distance ('softness') - Featherbed
'Softness'
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
19 - Track (vehicle)
20 - Off-track
21 - Path (foot, sheep)
22 - Off-path


PollyBell penetration ('softness')
'Softness'
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32


Adjusted penetration depth ('softness')
'Softness'
25.0
20.0
15.0
10.0
5.0
0.0
S1 S2 S2-track S4A S4B S3 S5 A-F-54 A-F-10 A-F-20 B-F-20 B-F-54 B-F-10 C-F-10 C-F-54 C-F-20 D-10-F D-20-F D-54_F D-10-G D-54-G D-20-G

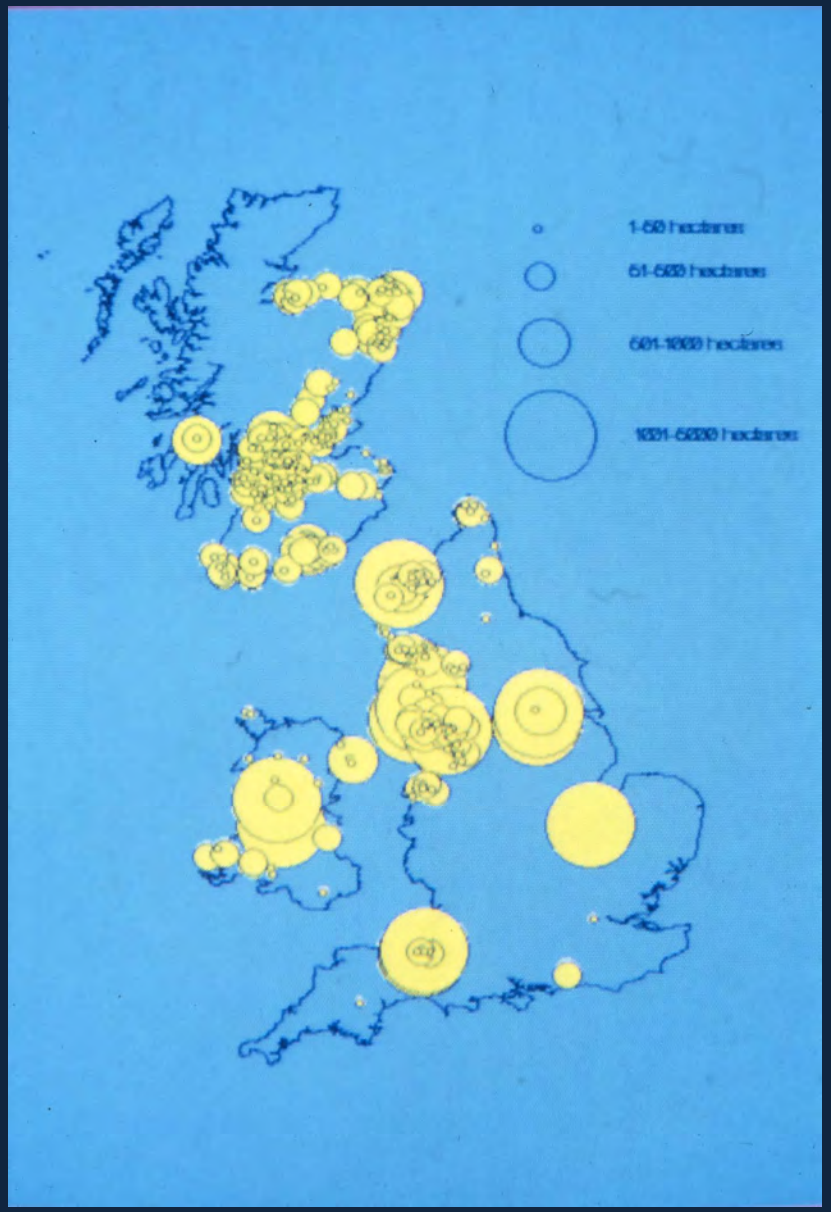

Adrian Tync: Creative Commons Attribution-Share Alike 4.0 International

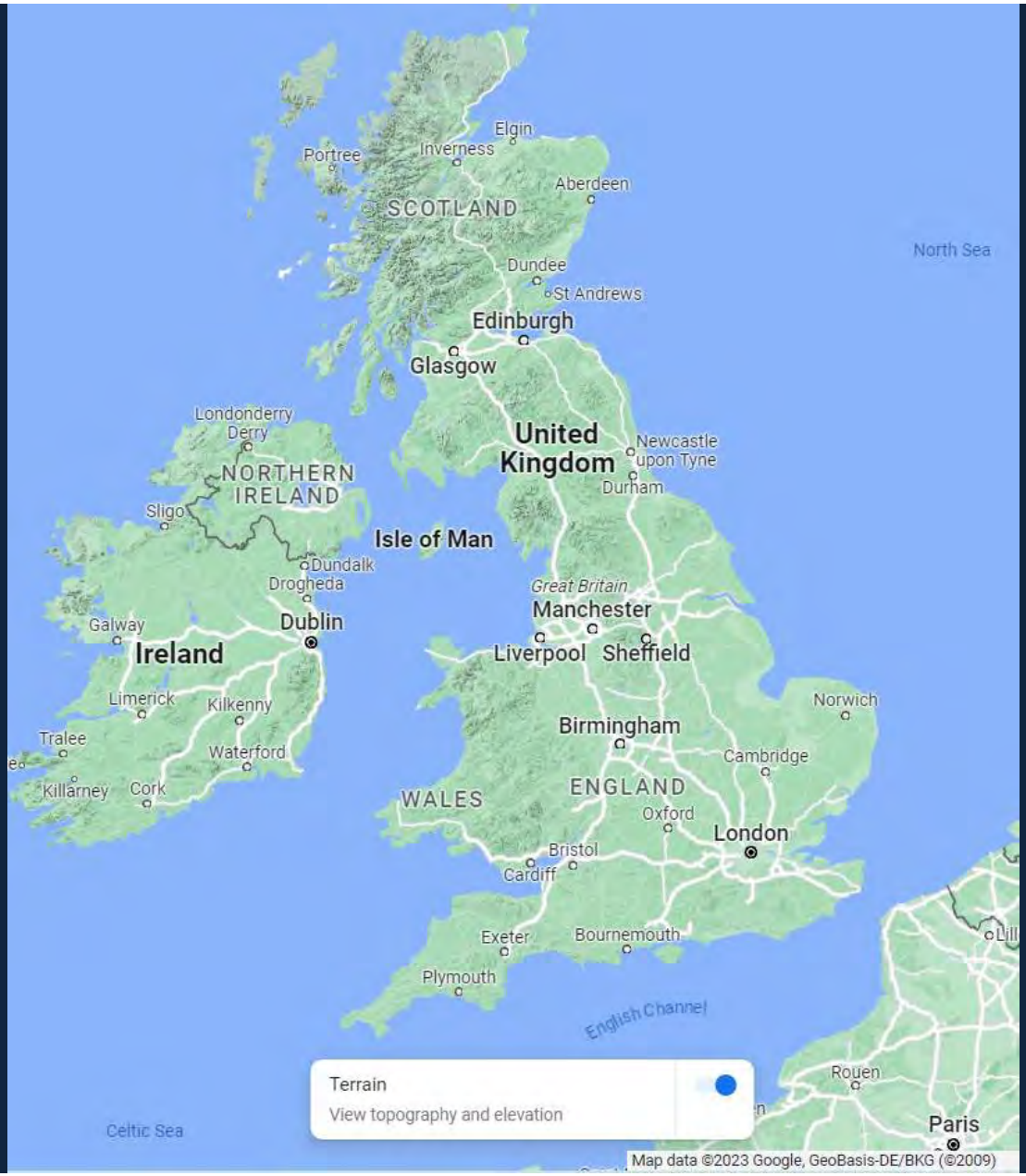

5/19
R LINDSAY 2015


Photo by Chuck Szmurlo: Creative Commons Attribution-Share Alike 3.0 Unported

Favourable Conservation Status

…the *natural* range is stable or increasing…


1-60 hectares
61-600 hectares
601-1000 hectares
1001-6000 hectares


Elgin
Inverness
Portree
Aberdeen
SCOTLAND
North Sea
Dundee
St Andrews
Edinburgh
Glasgow
Londonderry
Derry
United
Kingdom
Newcastle
upon Tyne
NORTHERN
IRELAND
Durham
Sligo
Isle of Man
Dundalk
Drogheda
Great Britain
Manchester
Galway
Dublin
Ireland
Liverpool
Sheffield
Limerick
Kilkenny
Norwich
Birmingham
Tralee
Waterford
Cambridge
ENGLAND
Killarney
Cork
WALES
Oxford
London
Bristol
Cardiff
Exeter
Bournemouth
Plymouth
English Channel
Terrain
View topography and elevation
Rouen
Celtic Sea
Paris
Map data ©2023 Google, GeoBasis-DE/BKG (©2009)

JWICK

Trauma Team Works Towards a Common Goal at Role 3 Hospital in Afghanistan

CORPSMAN, FLEET AND THE FLEET MARINE FORCE, HOSPITALS NO COMMENTS

By Cmdr. Mark Lenert and Lt. Cmdr. Ian Valerio, Role 3 Multinational Medical Unit, Kandahar, Afghanistan

The medical team at the Role 3 NATO hospital prepares to work on a patient in the operating room. photo)

The pager goes off. It is a Trauma "A" alert, "IED blast casualty with multiple wounds"... another reminder of being in a warzone, and part of the daily life of the medical care team at the Role 3 Multinational Medical Unit in Kandahar, Afghanistan.

The staff wonder if it is a U.S. or coalition member? An Afghan National Army or Police member? An Afghan local? What are the injuries?

The medical team, composed of an anesthesiologist, emergency room physician, a general surgeon, a trauma surgeon, two nurses, and two corpsmen, rushes to the ER to prepare and receive the casualty. Other medical personnel stand behind the "red line," immediately available if their skills or assistance are needed.

U.S. Navy, Bureau of Medicine and Surgery, Public domain, via Wikimedia Commons

Navy Medicine Video

Navy Medicine is a global healthcare network of 63,000 Navy medical personnel around the world who provide high quality health care to more than one million eligible beneficiaries. Navy Medicine personnel deploy with Sailors and Marines worldwide, providing critical mission support aboard ship, in the air, under the sea and on the battlefield.

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Navy Medicine Live Archives

February 2015 (15)

January 2015 (12)

December 2014 (17)

November 2014 (11)

Dartmoor: Ecohydrological trajectories of change

IUCN Peatland Conference
5th October 2023

Dr Pia Benaud, Dr Naomi Gatis, Lou Goodger, Prof Karen Anderson, Prof Richard Brazier

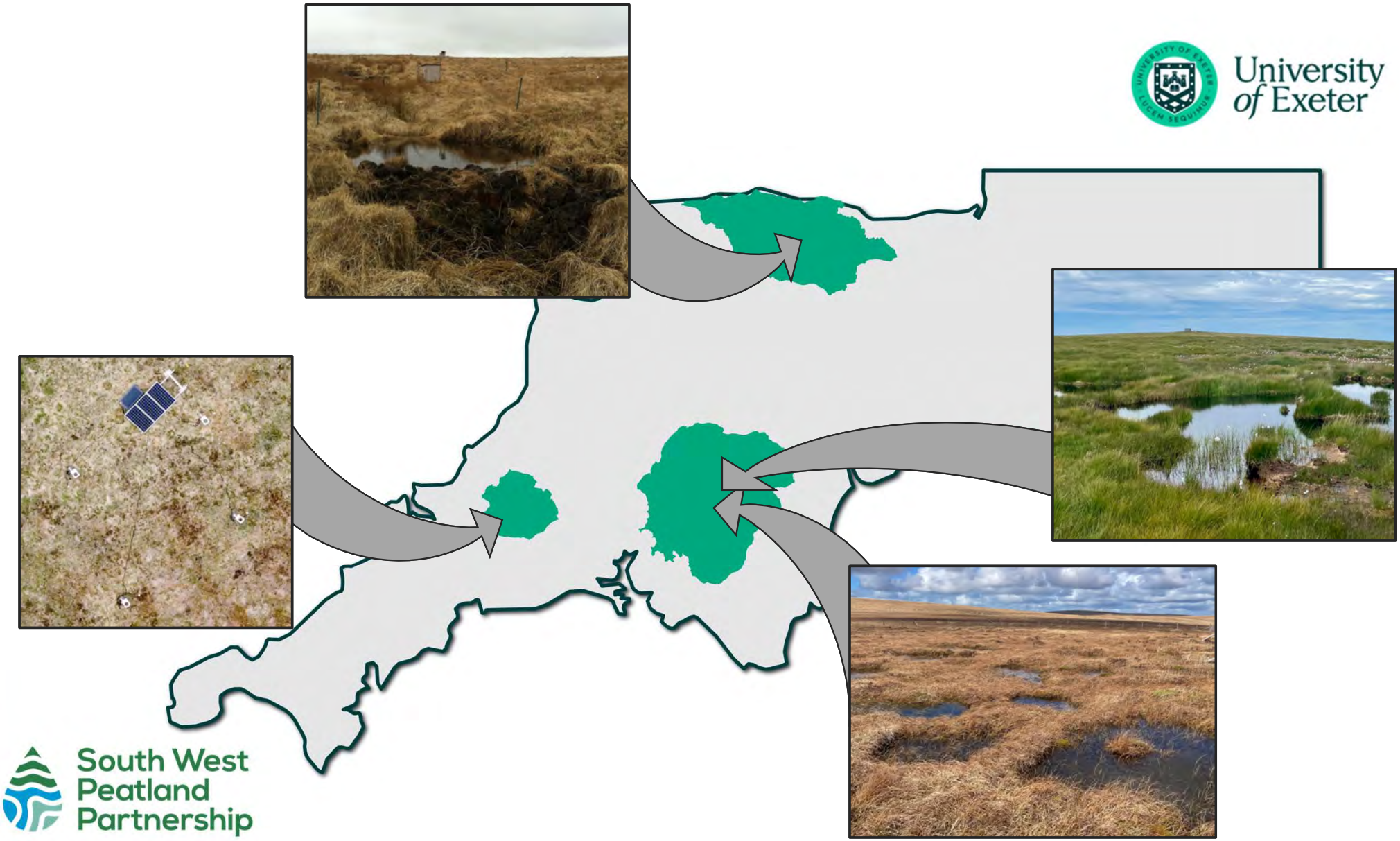
South West Peatland Partnership

University of Exeter | Centre for Resilience in Environment, Water and Waste

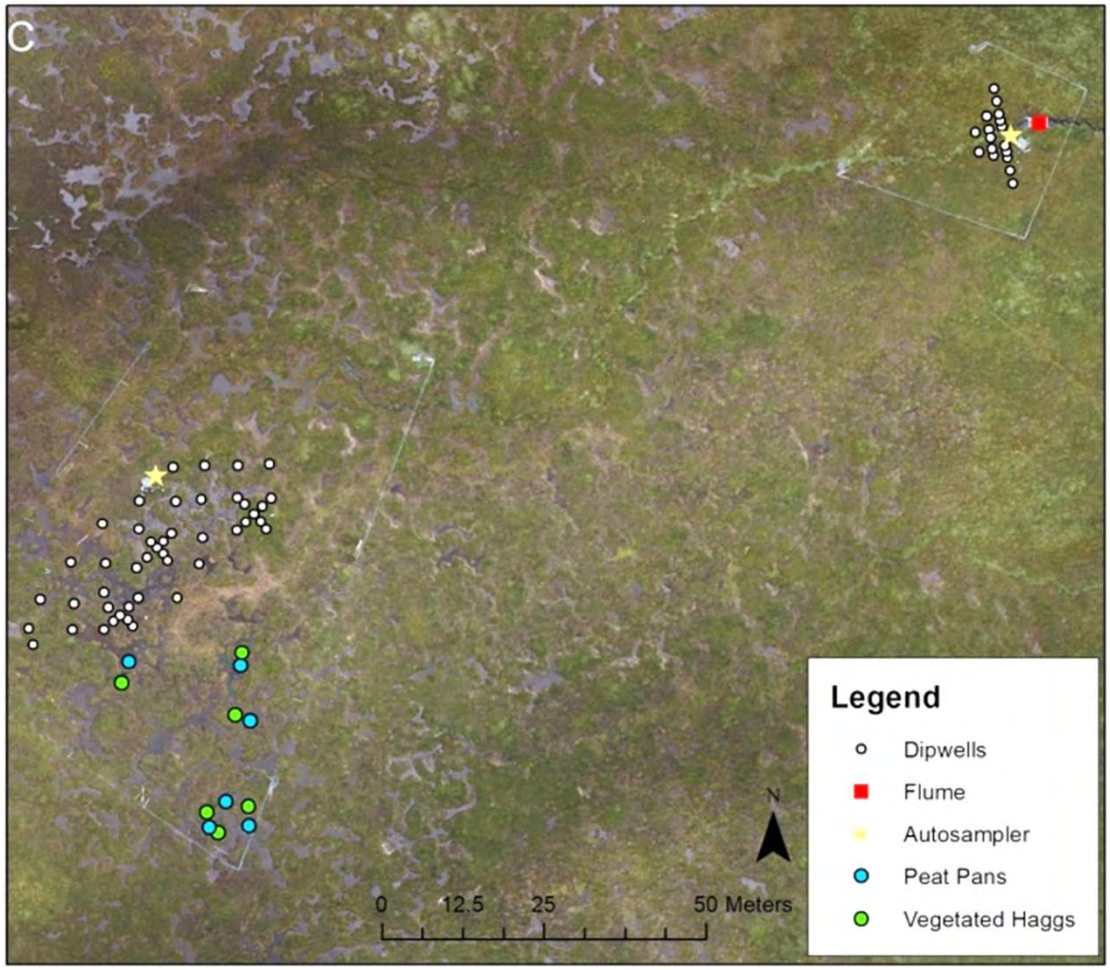
South West Water

Overview

- Brief intro to our work
- Dartmoor blanket bog; short-term ecohydrological impacts
- Space-for-time experiment to understand longer-term impacts

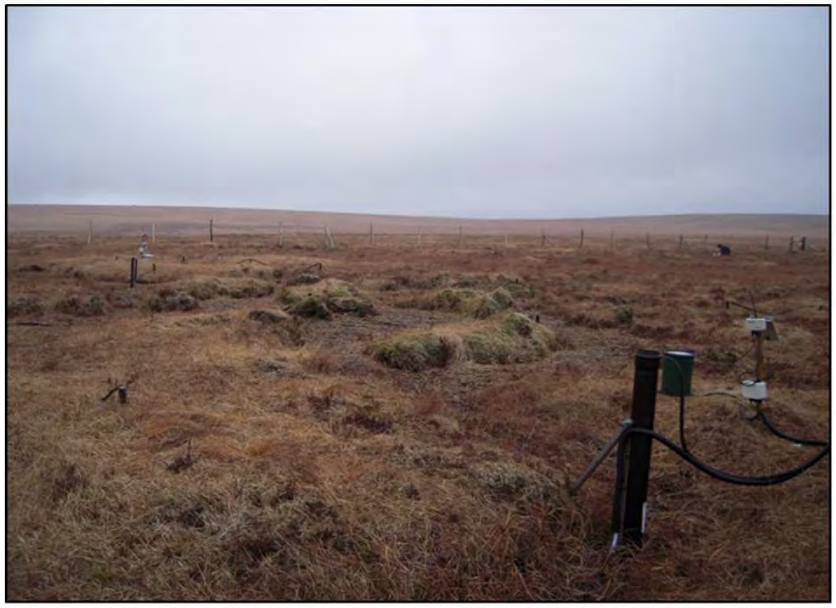

University of Exeter
South West Peatland Partnership

Flat Tor Pan - Dartmoor



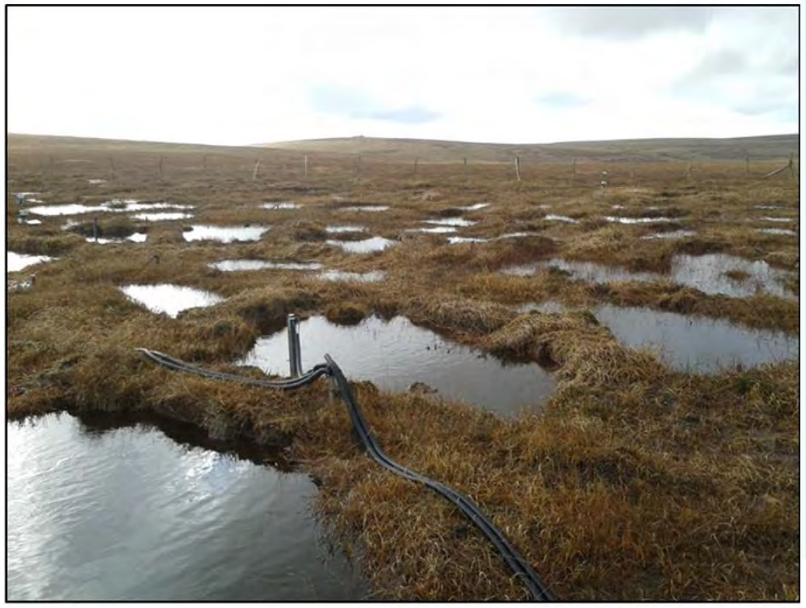
Primary monitoring:

- Flow
- Water table depth
- Water Quality – DOC, Colour
- GHG Fluxes – CO_2, CH_4



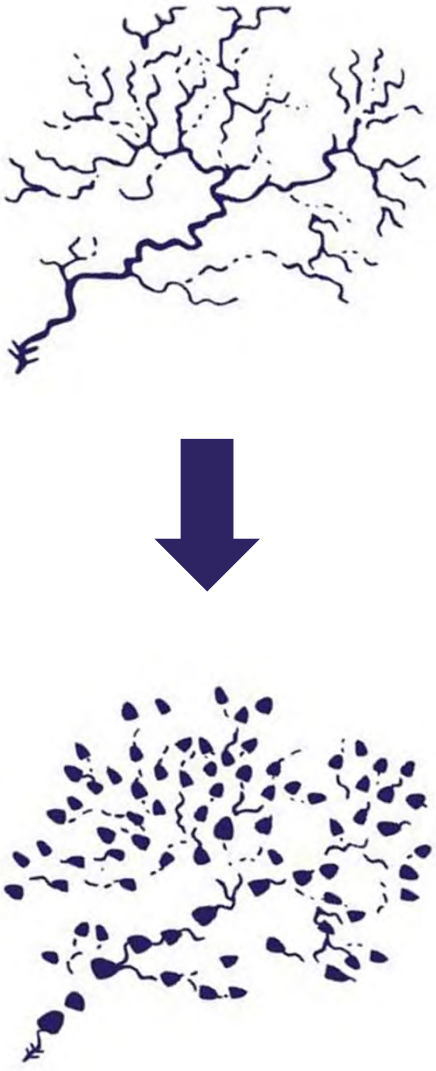
Before Restoration

2012-2014



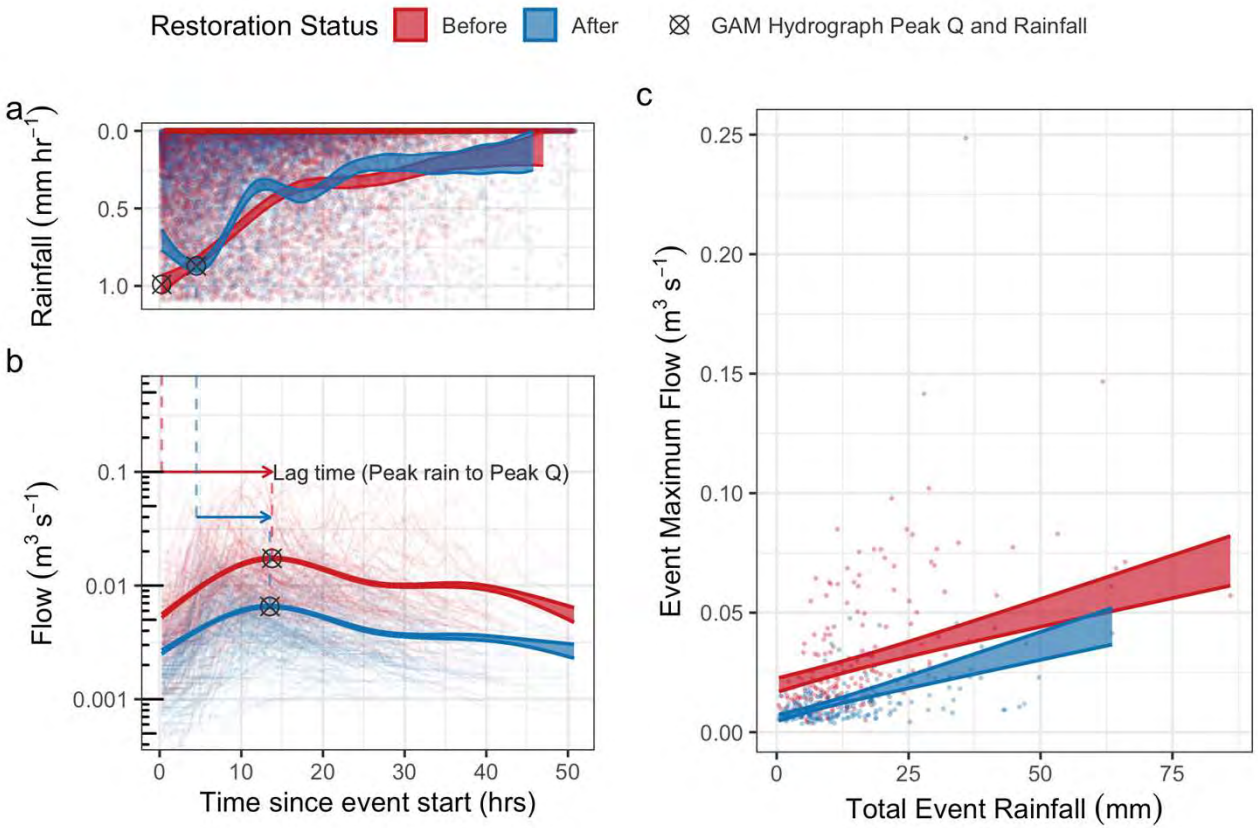
After Restoration

2014-2018



Gatis, N., Benaud, P., Anderson, A., Ashe, J., Grand-Clement, E., Luscombe, D.J., Puttock, A. and Brazier, R.E. (2023) Peatland restoration increases water storage and attenuates downstream stormflow but does not guarantee an immediate reversal of long-term ecohydrological degradation. *Nature Scientific Reports*

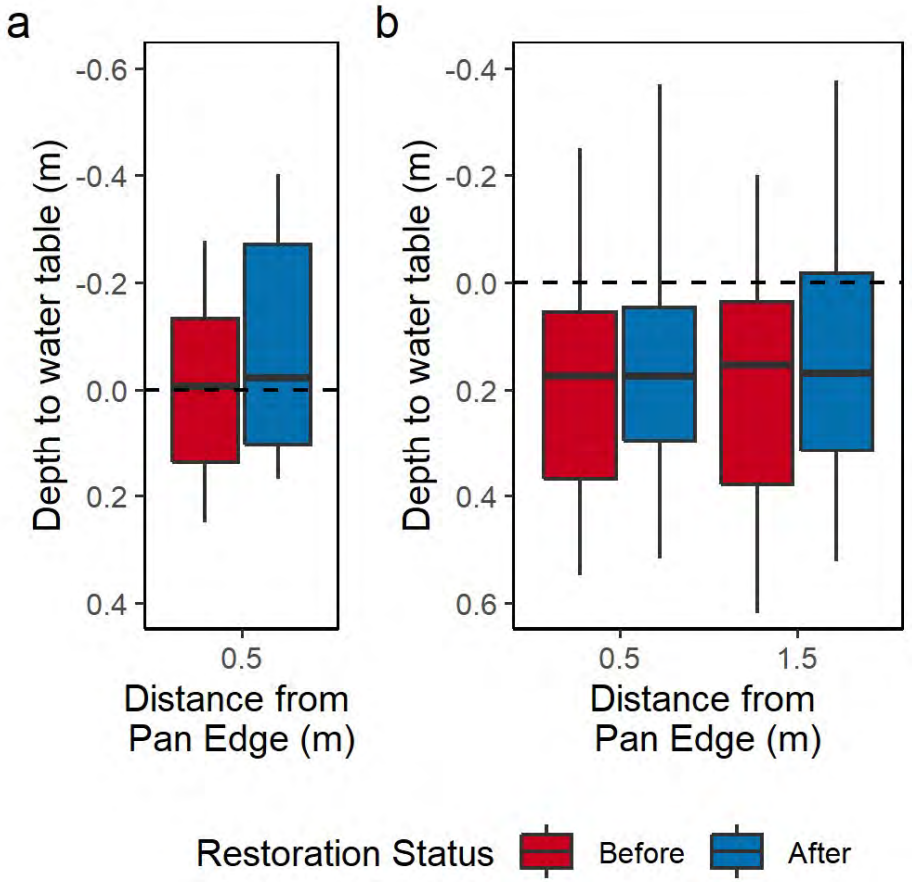
Changes to flow



Event based analysis:

- 33 % reduction in lag times
- 68 % reduction in rising limb gradient
- 49 % reduction in peak flows
- 21.4 % reduction in the overall variability in flow
- Highest flows (Q5) ↓ 66 %
- Lowest flows (Q95) ↓ 57 %

Water Table Depth



Peat pans:

- Increase in WT during wetter conditions (Q5) - 1.4 cm
- Increase in WT during drier conditions (Q95) – 3.5 cm

Haggs:

- Increase in WT during wetter conditions (Q5) - 0.9, 5.3 cm
- Increase in WT during drier conditions (Q95) – 7.3, 6.4cm

Water Table Depth

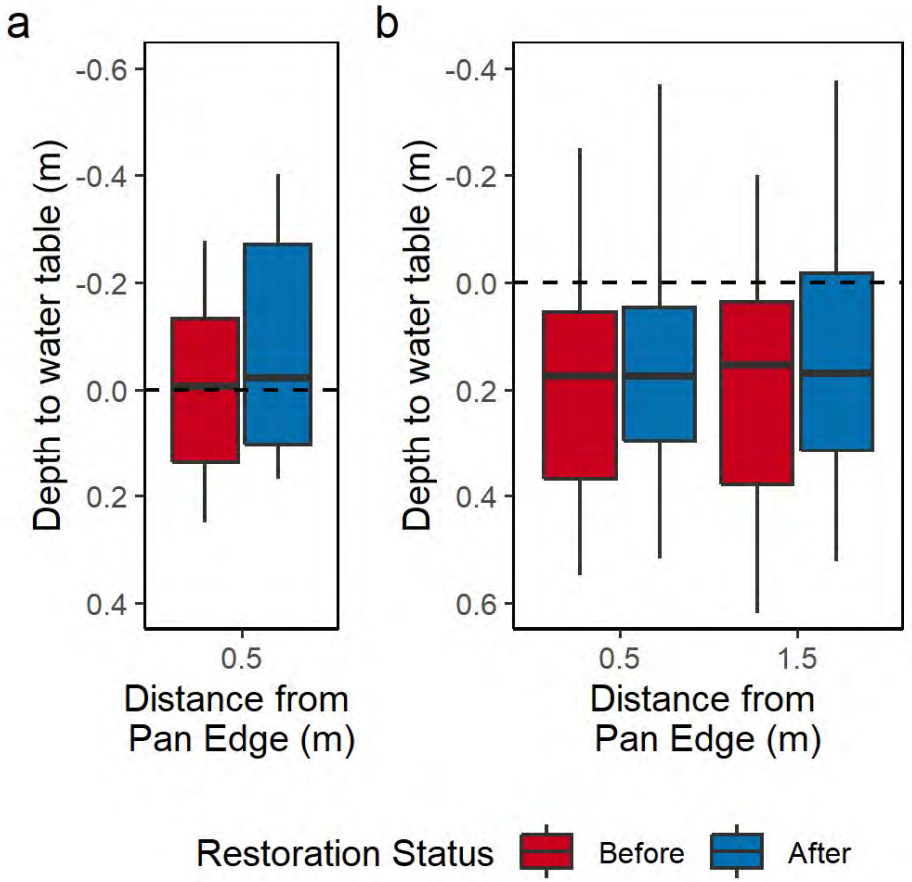
Peat pans:

- Increase in WT during wetter conditions (Q5) - 1.4 cm
- Increase in WT during drier conditions (Q95) – 3.5 cm

Haggs:

- Increase in WT during wetter conditions (Q5) - 0.9, 5.3 cm
- Increase in WT during drier conditions (Q95) – 7.3, 6.4cm

Water Table Depth



Peat pans:

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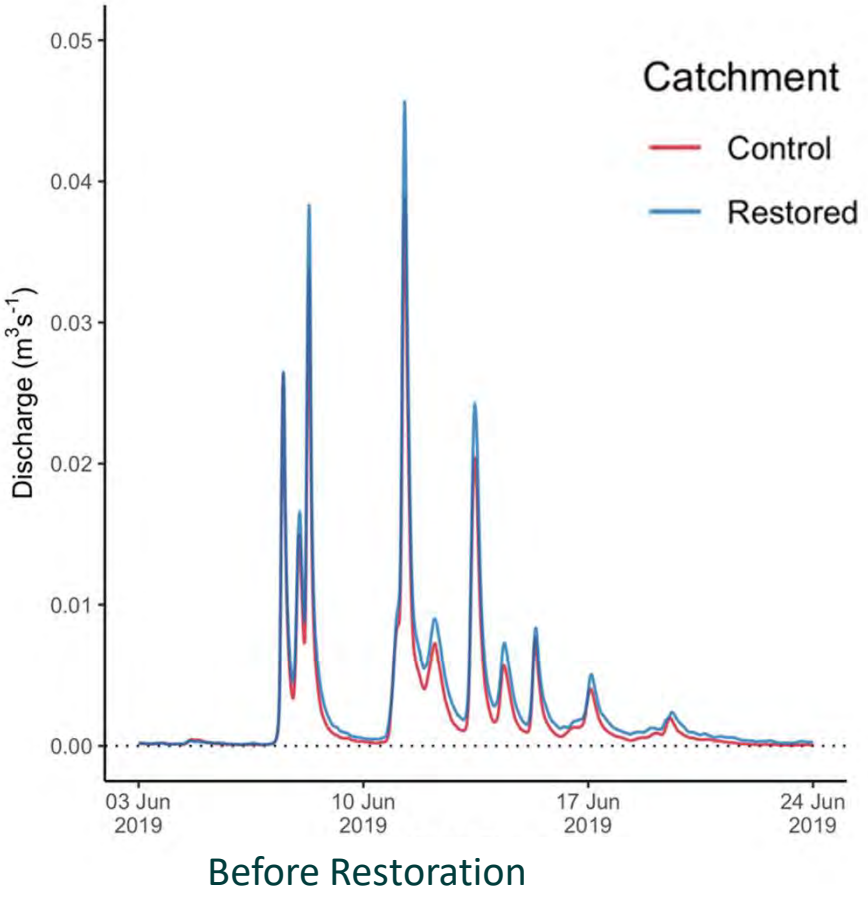
Haggs:

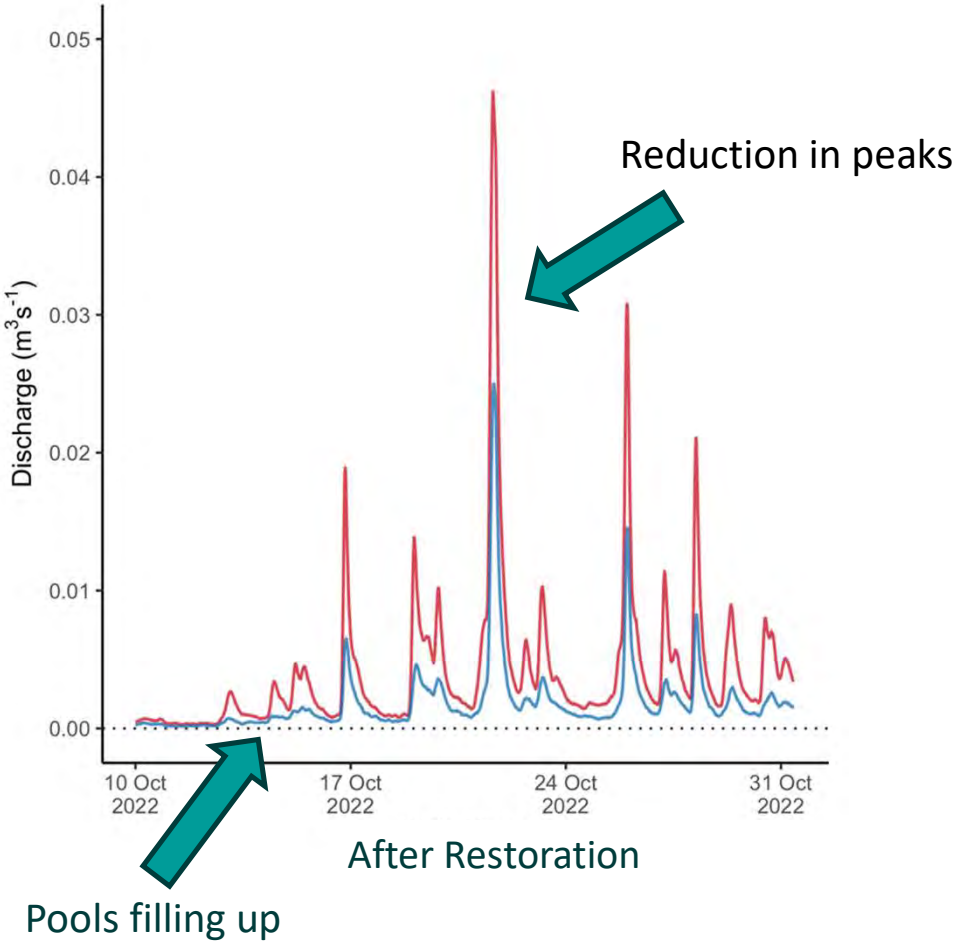
- Increase in WT during wetter conditions (Q5) - 0.9, 5.3 cm
- Increase in WT during drier conditions (Q95) – 7.3, 6.4cm

Hydrological changes elsewhere

Hangingstone Hill: Flow



Before Restoration

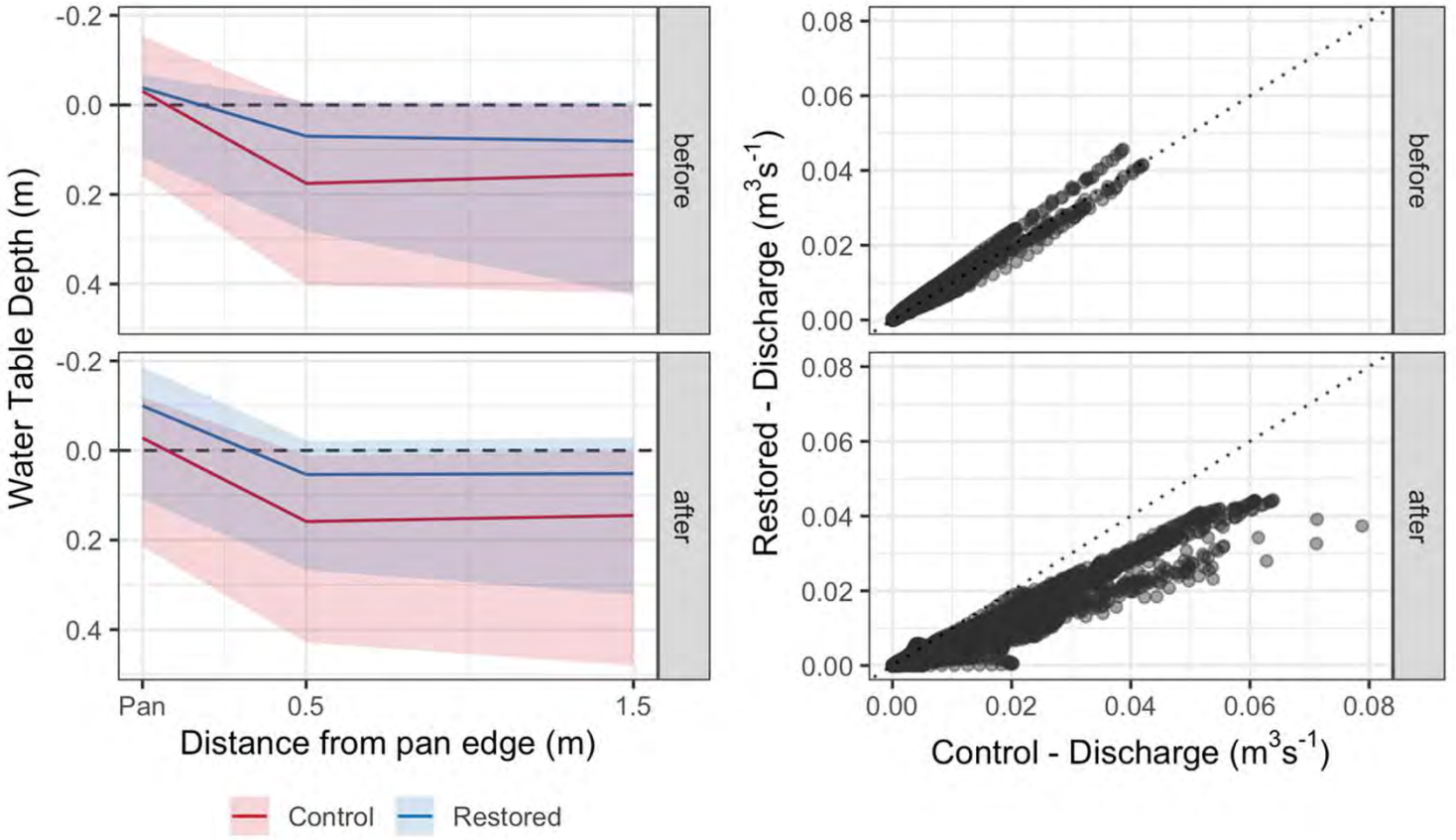


After Restoration

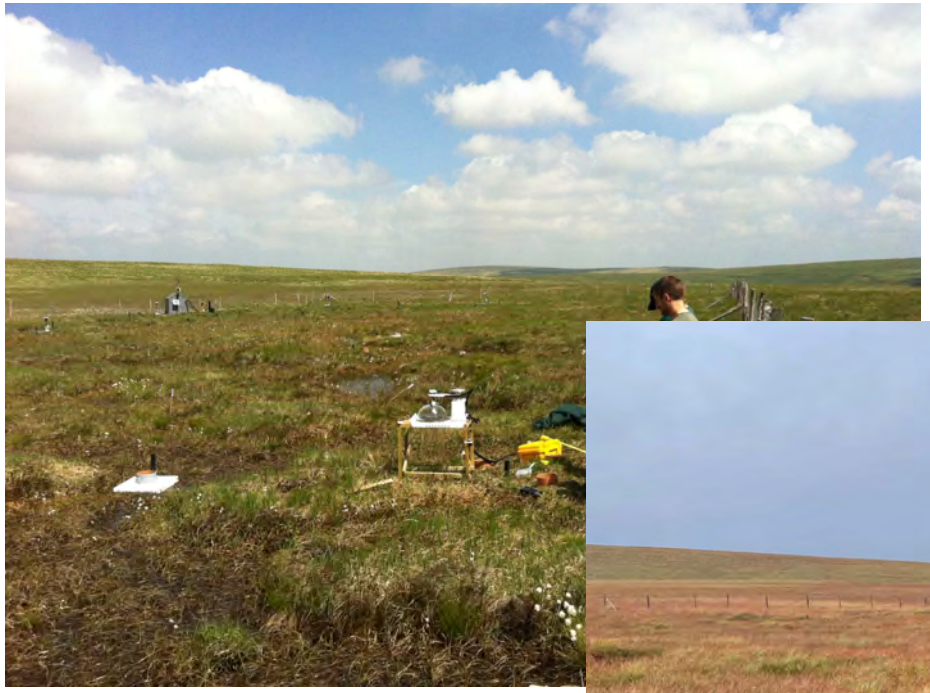
Pools filling up

Hangingstone Hill: Flow + WTD

- Water table is less variable
- More water stored in the pans/pools
- Slight increase in mean WTD
- Significant reduction in flows

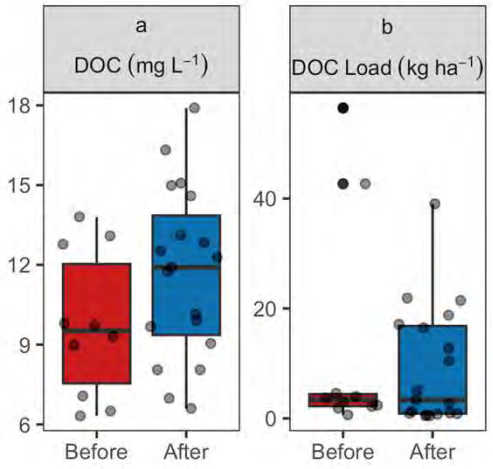


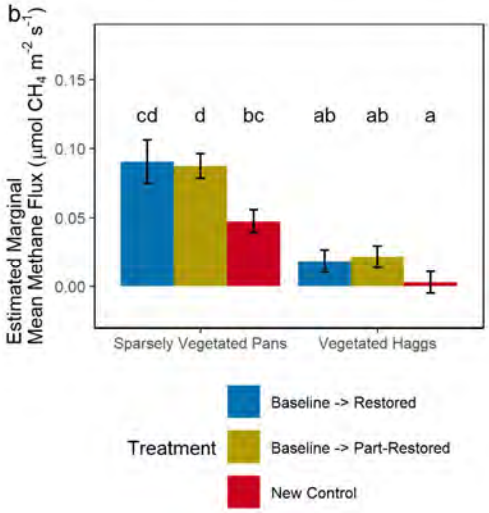
University of Exeter



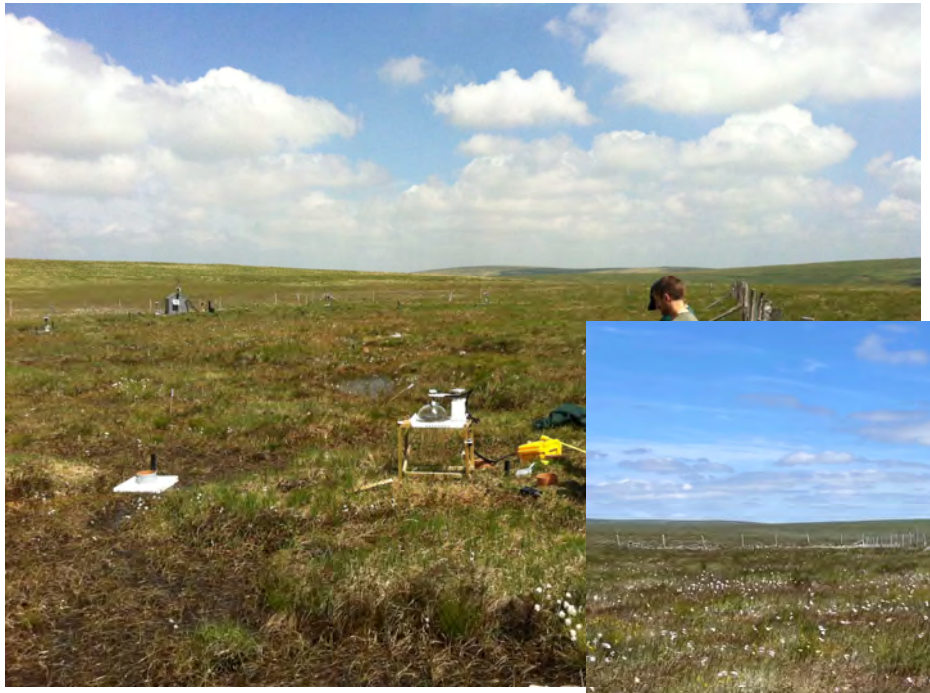
Before Restoration
June 2013

After Restoration
September 2022





Changes to ecohydrological function

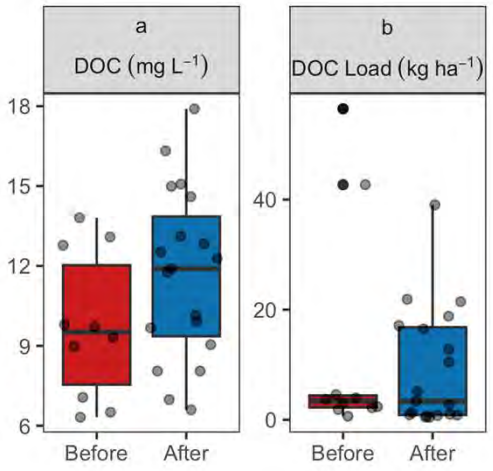


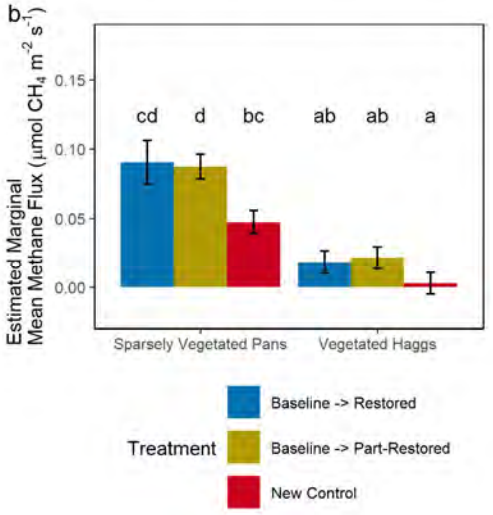
Before Restoration
June 2013

After Restoration
July 2022

Changes to ecohydrological function

Observations
2012 - 2018



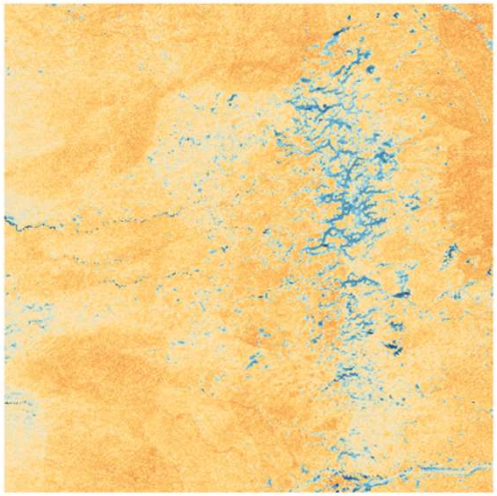


Trajectory of change for Dartmoor

- Space-for-time experimental design
- Pristine – realistic target?
- 10 years, 4 years and Control
- Monitoring:
  - CO_2 and CH_4 fluxes
  - Water table depth
  - Flow
  - Water quality

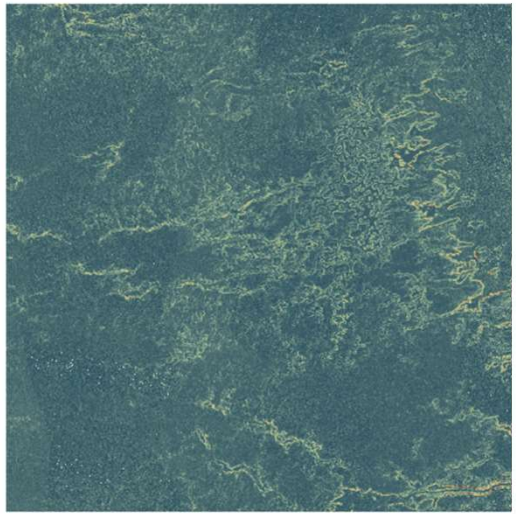
2010 geospatial data

LiDAR - Intensity



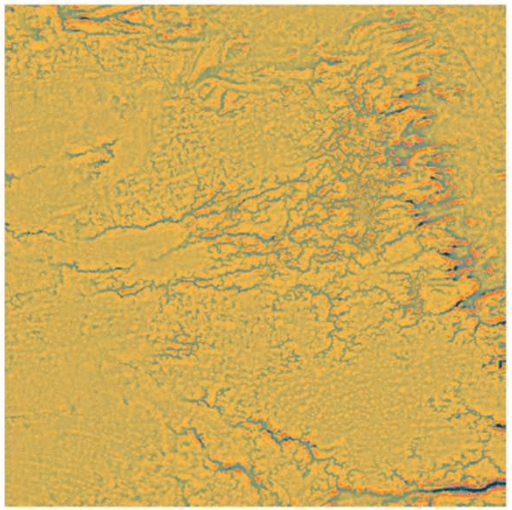
Great measure of wetness and areas of bare peat

LiDAR - Roughness



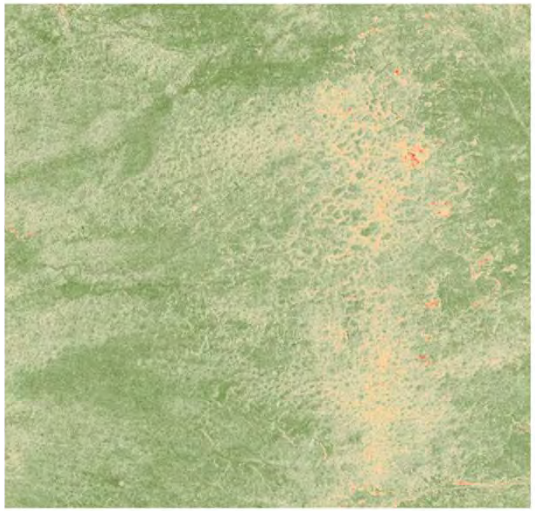
Great measure of microtopography

Structure - Topographic Position Index



Terrain relative to surrounds

RGB - Excessive Greeness



Vegetation vs. soil

And many others…

2010 RGB imagery

Flat Tor Pan

Winney's Down

2021 RGB imagery

Flat Tor Pan

Winney’s Down

Hangingstone

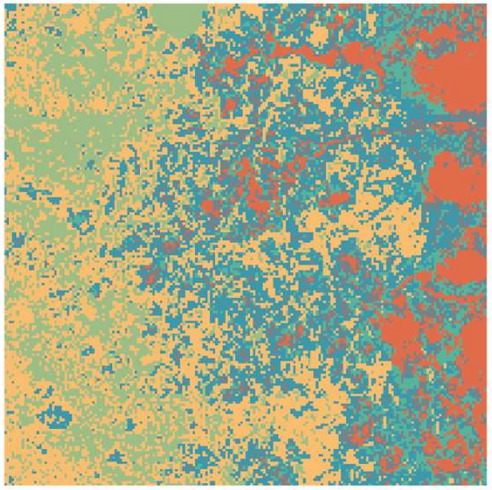
2010 RGB imagery

Flat Tor Pan

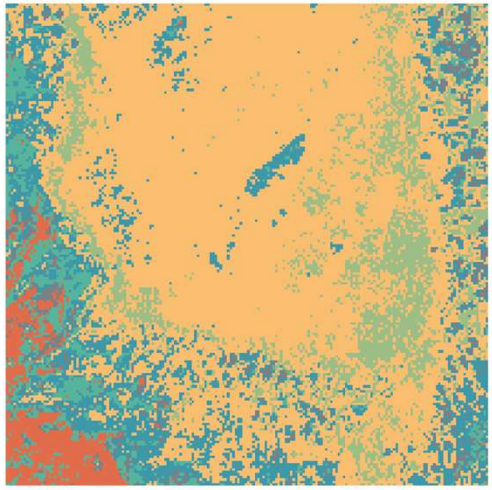
Winney's Down

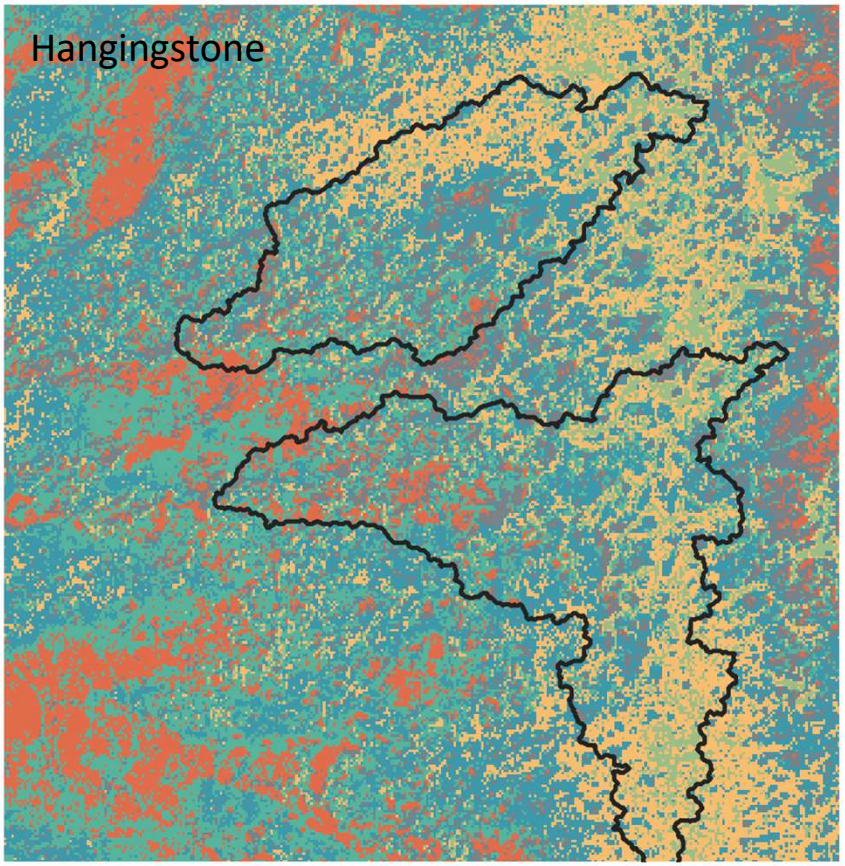
6 Habitat/Functional Classes

Flat Tor Pan



Winney's Down





- Mixed blanket bog
- Bog cotton dominated
- Transitional
- Molinia dominated
- ~~Molinia tussocks~~
- ~~Very dry & gully edges~~

Thank you.

Get in touch:
P.Benaud@exeter.ac.uk
@piabenaud

University of Exeter | Centre for Resilience in Environment, Water and Waste

South West Peatland Partnership

South West Water

Dartmoor National Park

DPA Friends of Dartmoor

The Dartmoor Society

Department for Environment Food & Rural Affairs

Duchy of Cornwall

Environment Agency

Exmoor National Park

The Exmoor Society

Historic England

Ministry of Defence

National Trust

Natural England

rspb

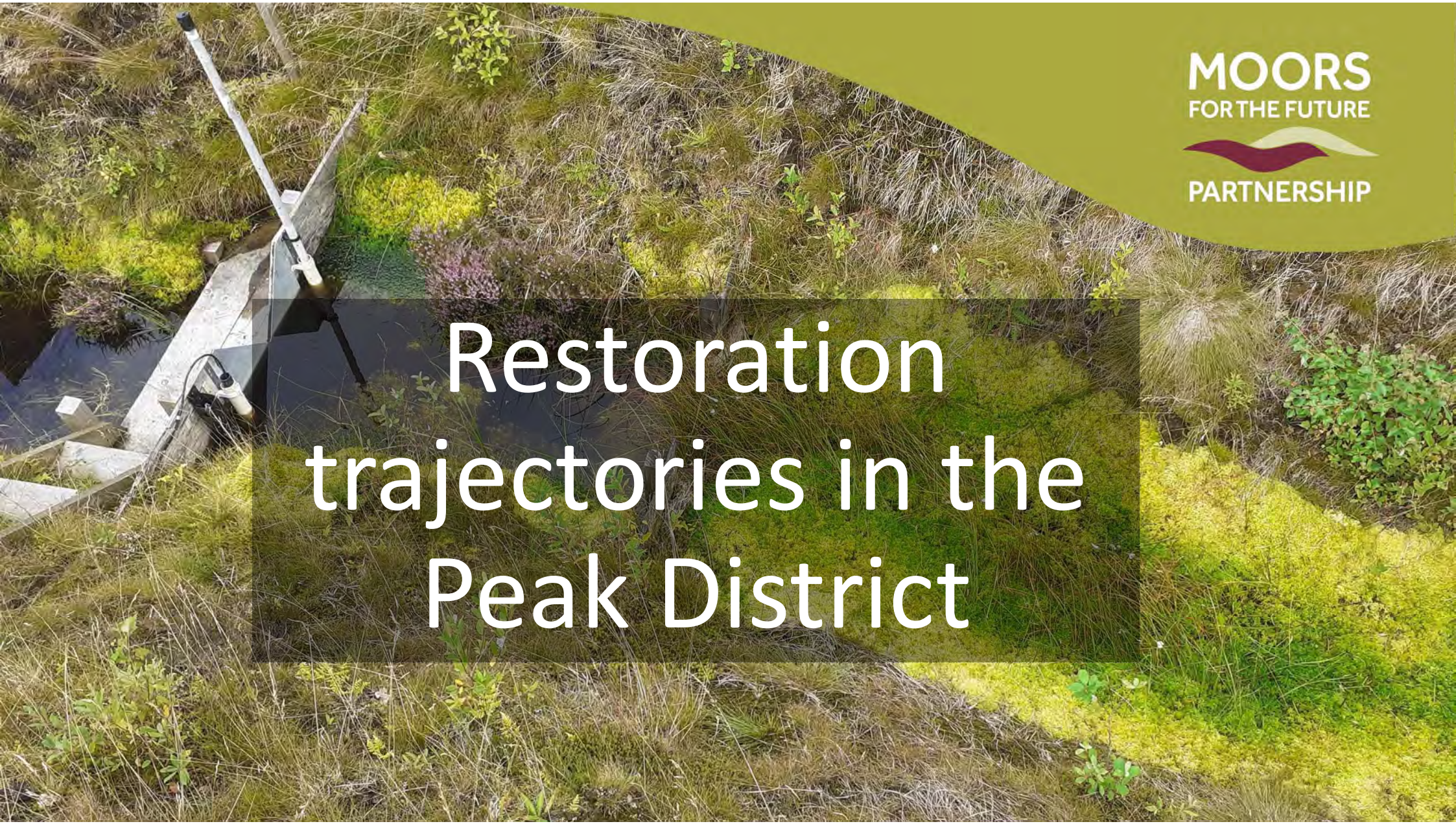
University of Plymouth

Westcountry Rivers Trust

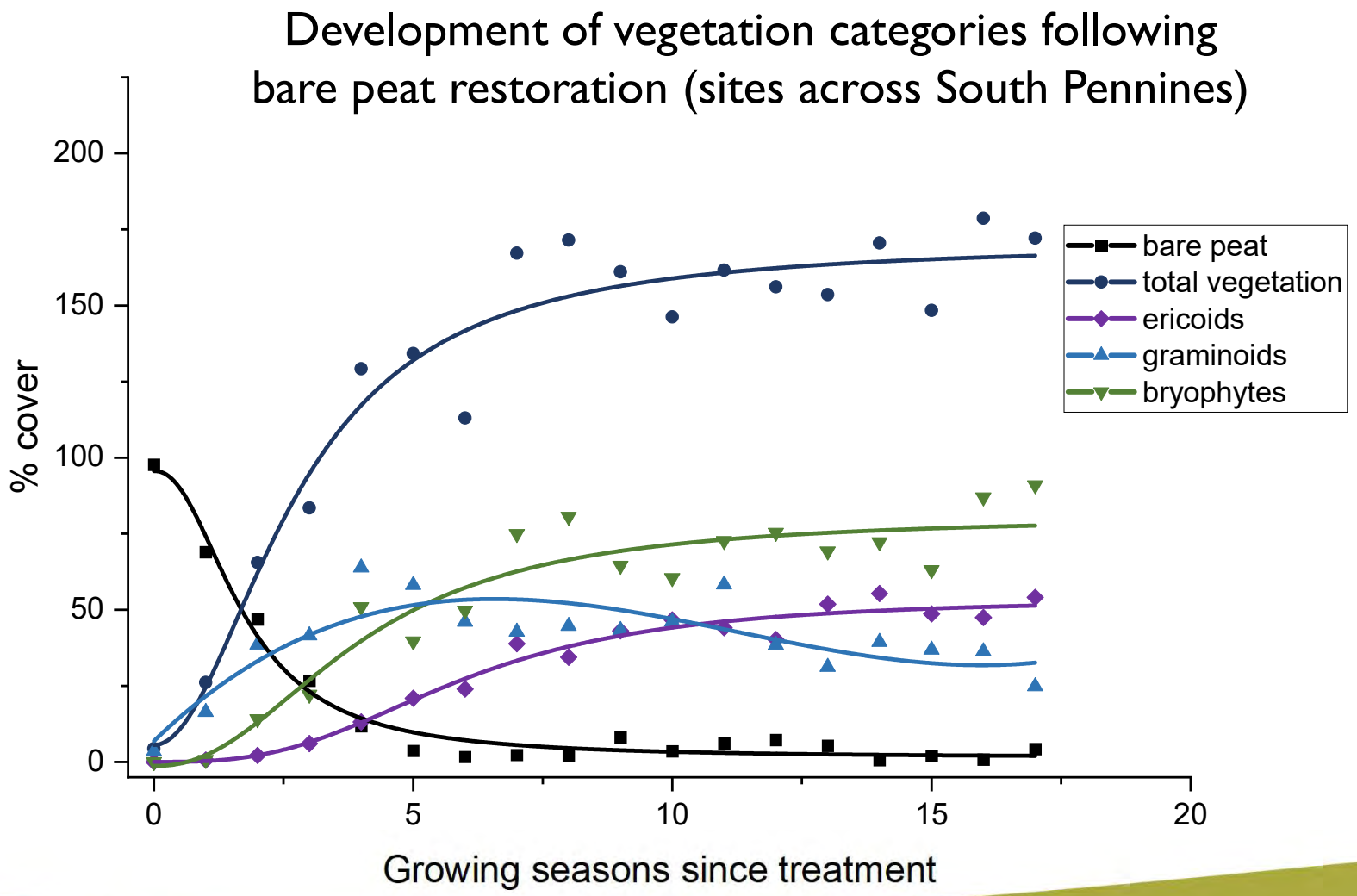
Woodland Trust

The Wildlife Trusts Devon

With additional thanks to Dartmoor Commoners and Graziers, Exmoor Forest farmers and numerous other farmers and landowners without whom this project would not have been possible.

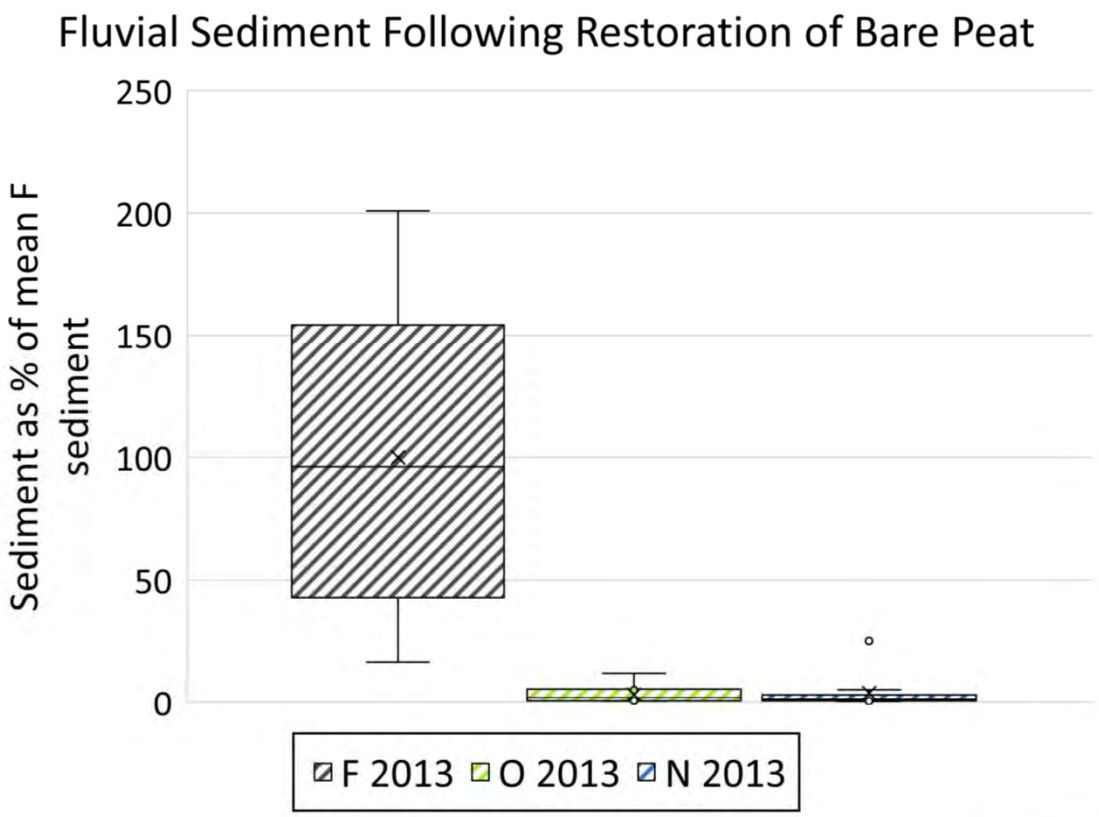


Restoration trajectories in the Peak District

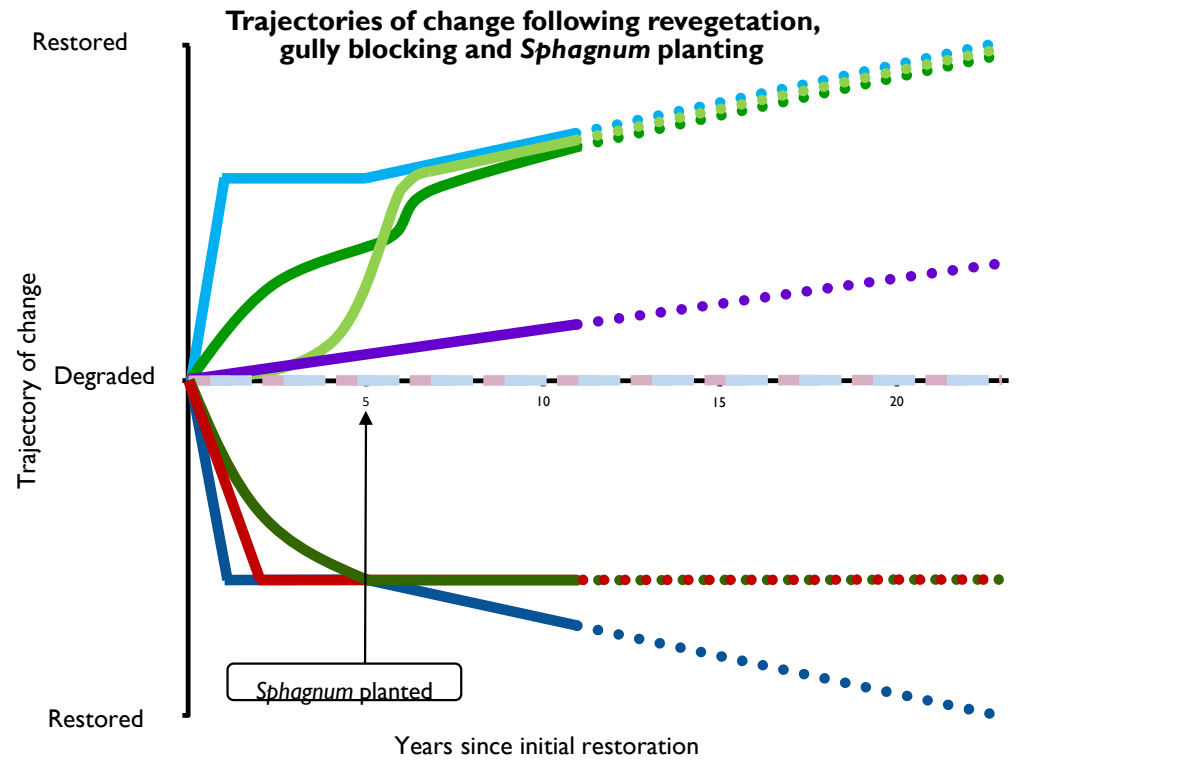

Development of vegetation categories following bare peat restoration (sites across South Pennines)
% cover
200
150
100
50
0
0
5
10
15
20
Growing seasons since treatment
bare peat
total vegetation
ericoids
graminoids
bryophytes

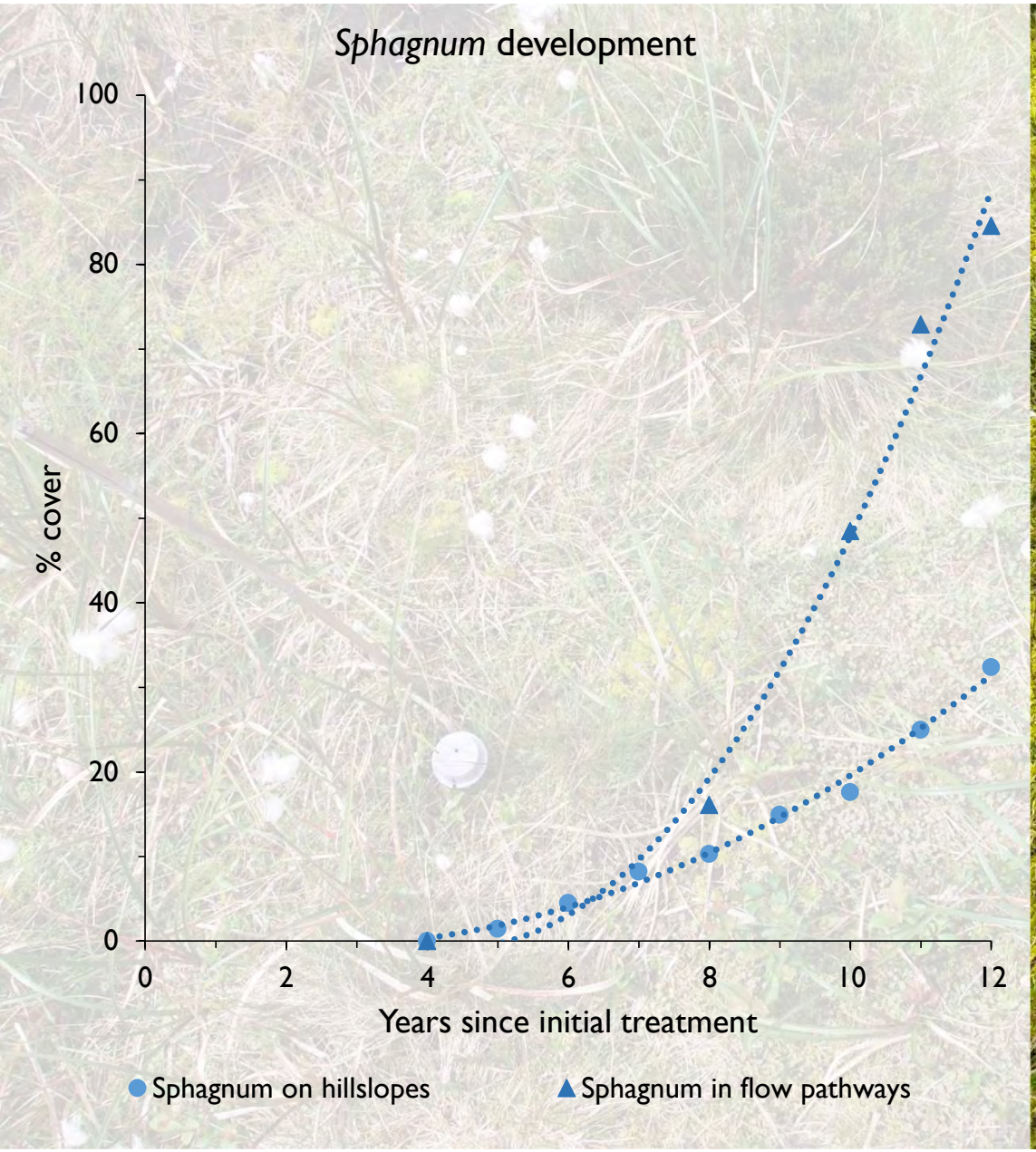
Sediment generation/transport

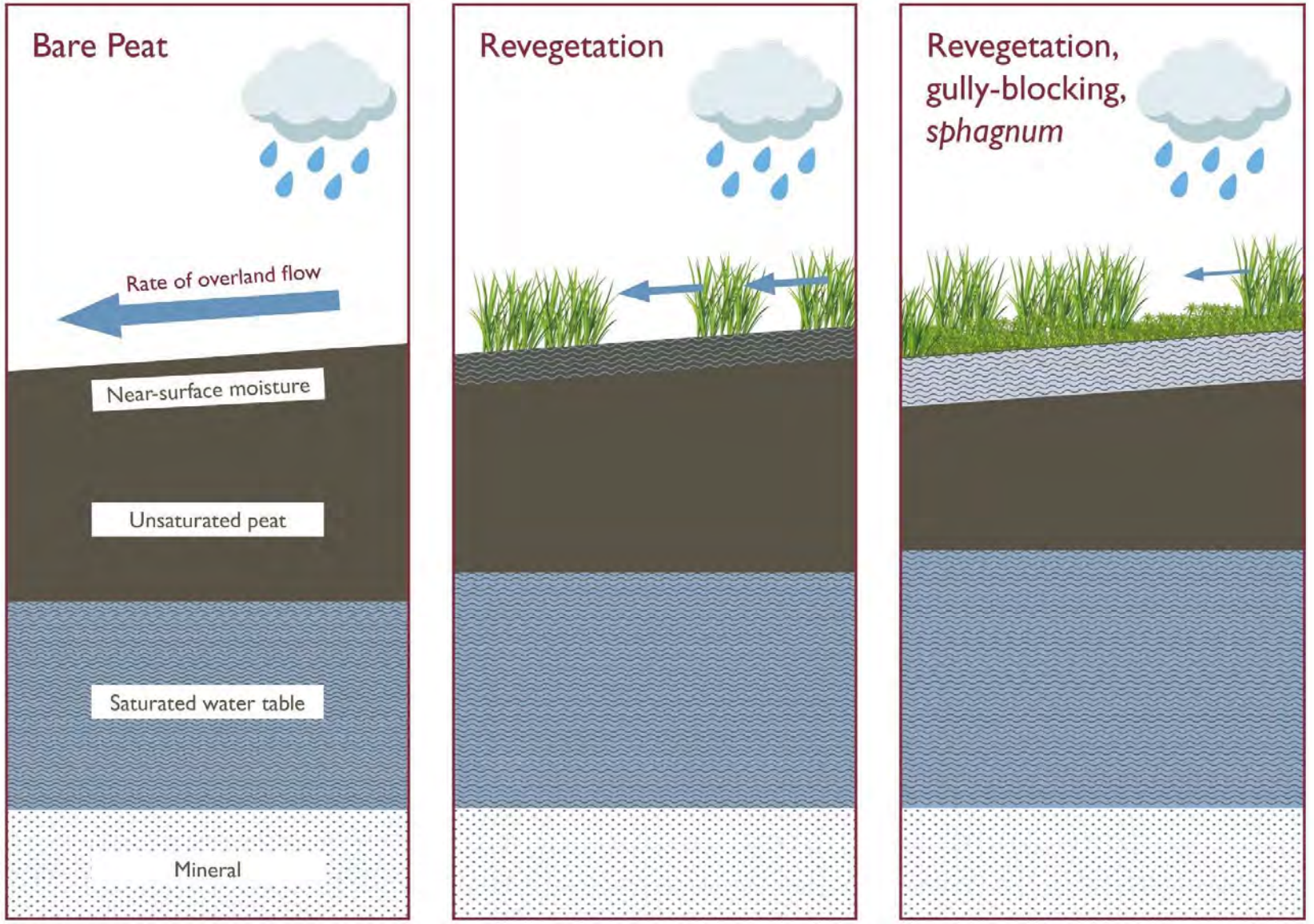
- 97% reduction in sediment within 18 months of initial treatment
- Possible additional benefit of *Sphagnum*
- Significant continuing erosion at untreated bare peat control site

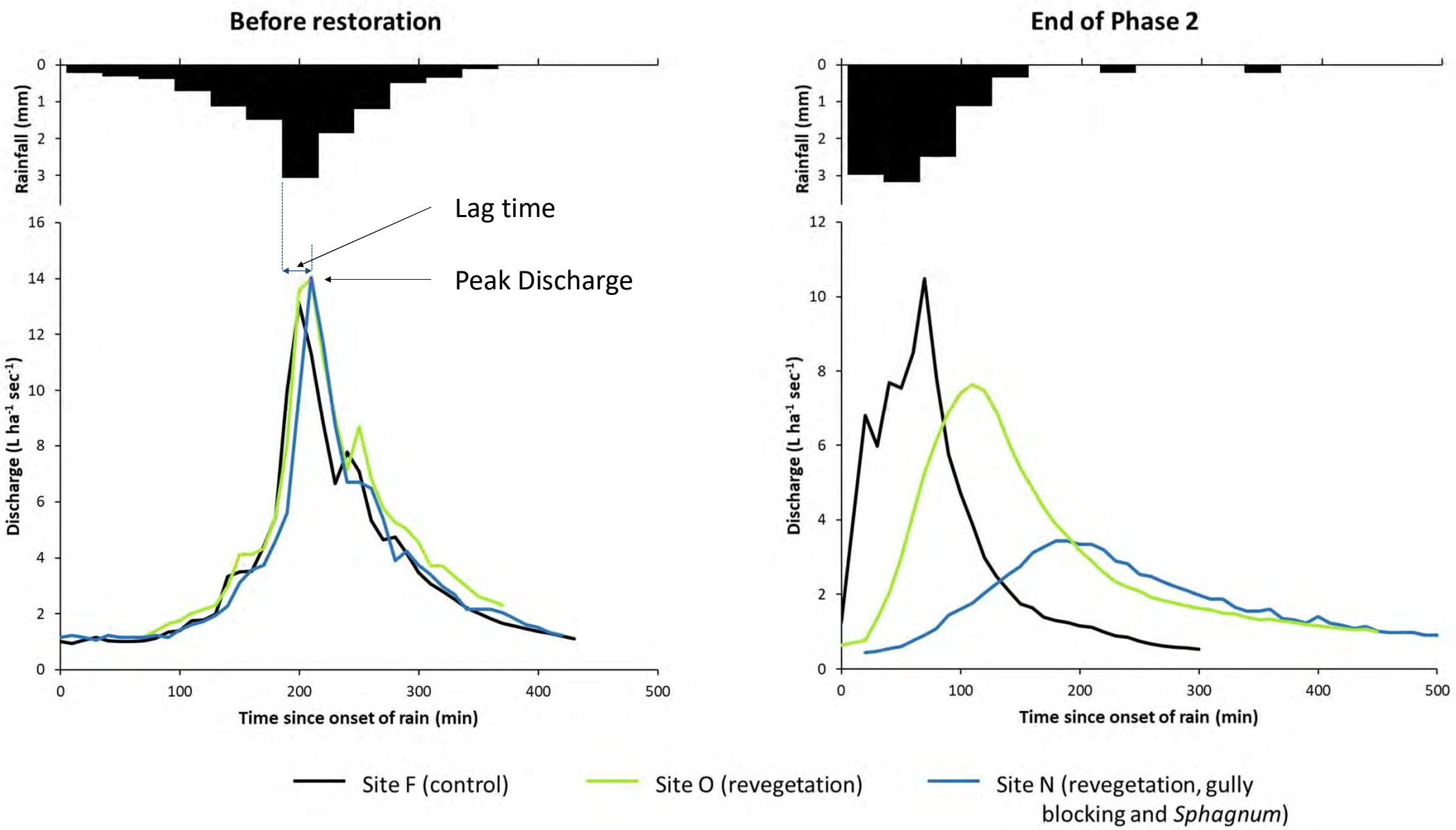


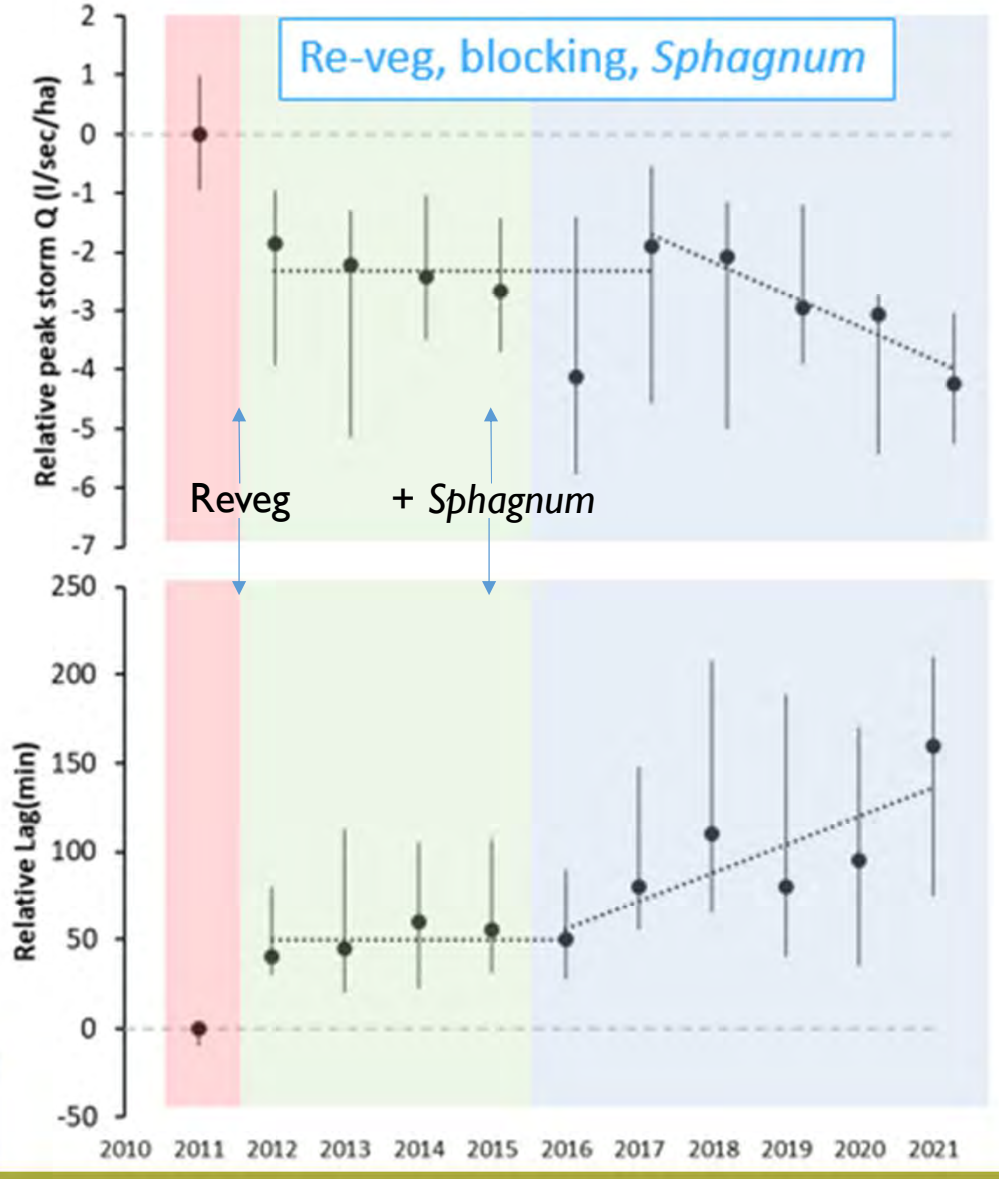

Bare peat revegetation
11 years


Trajectories of change following revegetation, gully blocking and *Sphagnum* planting
Restored
Degraded
Restored
Trajectory of change
5
10
15
20
Sphagnum planted
Years since initial restoration
Metric
Vegetation
Bare peat
Indicator species count
Indicator species cover
Streamflow
Peak discharge
Lag time
Runoff coefficient
Water table
Depth to water table
Water chemistry
Sediment erosion
Dissolved organic carbon


Sphagnum development
100
80
60
40
20
0
% cover
0
2
4
6
8
10
12
Years since initial treatment
Sphagnum on hillslopes
Sphagnum in flow pathways


Bare Peat
Rate of overland flow
Near-surface moisture
Unsaturated peat
Saturated water table
Mineral
Revegetation
Revegetation,
gully-blocking,
sphagnum

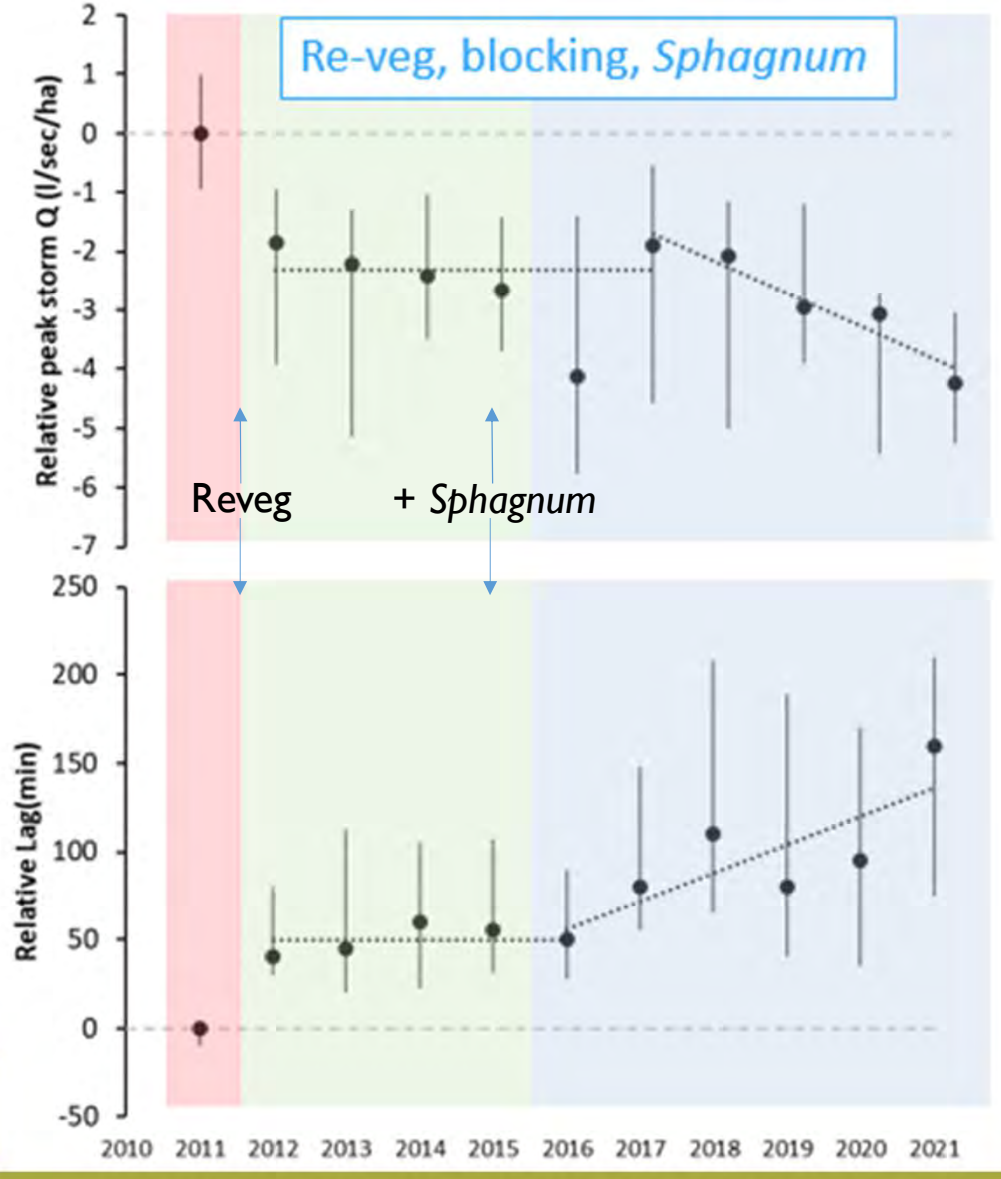

Before restoration
End of Phase 2
Rainfall (mm)
Lag time
Peak Discharge
Discharge (L ha-1 sec-1)
Time since onset of rain (min)
Site F (control)
Site O (revegetation)
Site N (revegetation, gully blocking and Sphagnum)



- 67 *percentage point* reduction in Peak Discharge

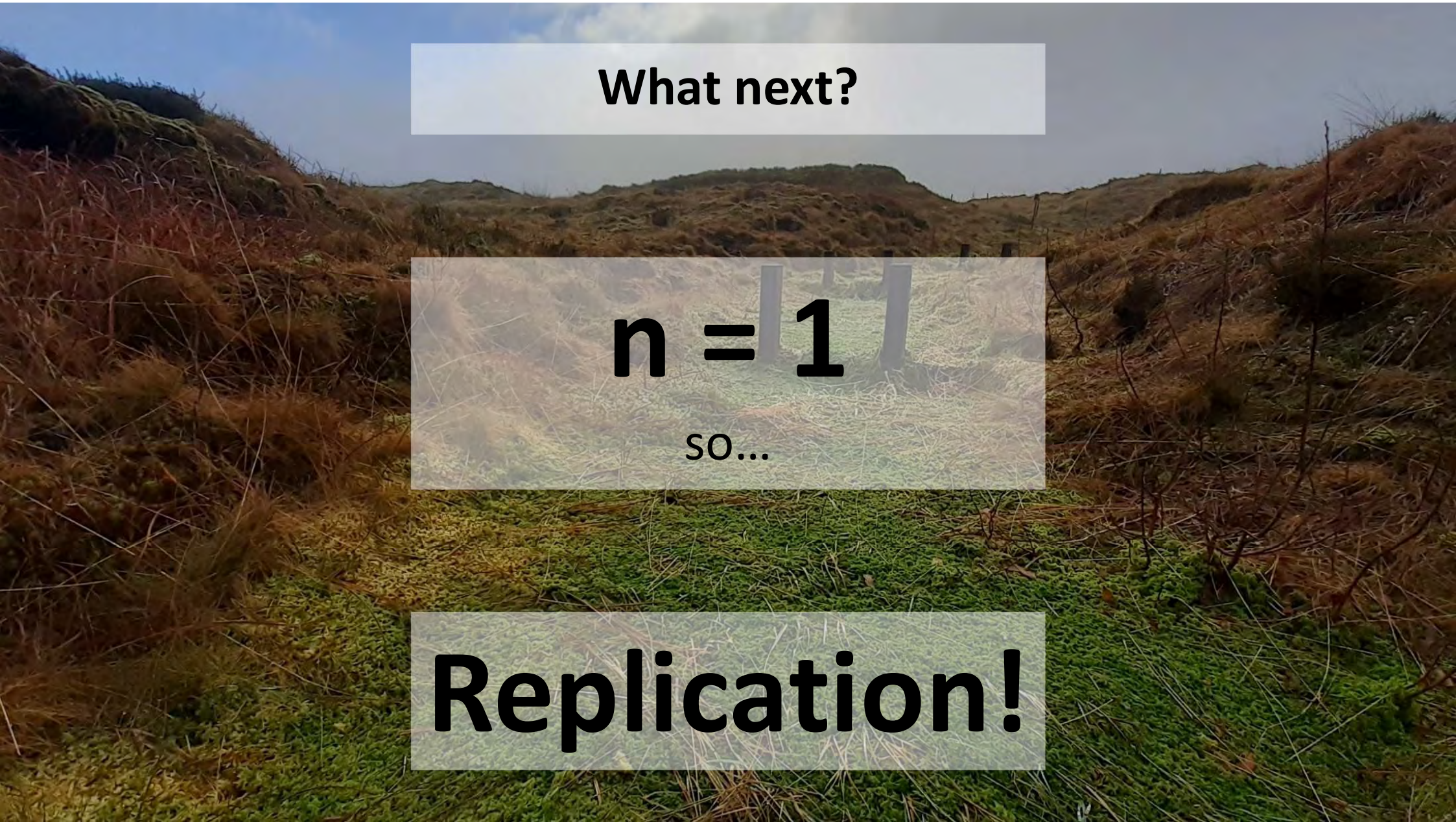
- 680 *pp* increase in lag time

- Changes are **continuing**



- Decreases in peak discharge scale with storm size
- Biggest benefits in the biggest storms
- Modelling suggests peak discharge in big storms would be reduced in communities at risk of flooding if whole catchments are restored

- Increases in lag time are maintained in “quick intense” events
- Significant additional benefits of *Sphagnum*


What next?
n = 1
so…
Replication!

Thanks for listening!
Any questions?

Jody.Vallance@peakdistrict.gov.uk

Peat Research Workshop - National Trust & Partners

28th February 2023, Calke Abbey, Derbyshire

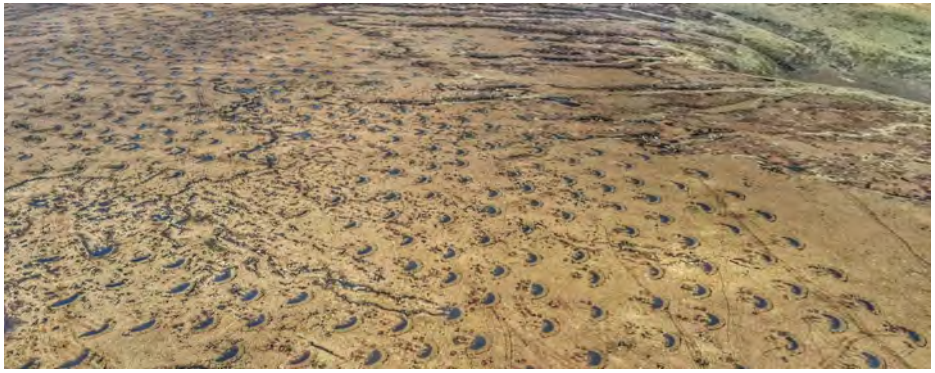
Proceedings

Agreed Research Priorities

1. Standard monitoring & data collection methods

2. Understanding restoration trajectories

3. Sector wide data framework & models



4. Decision making, trade offs and optimising benefits at a landscape scale

5. What works? Restoration techniques

Socio-economic considerations

Contact us

tia.crouch@nationaltrust.org.uk

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