



Welcome!

The webinar will start shortly



NFM Webinar: Moorland Restoration & NFM in Headwater Catchments, ProtectNFM

Professor Martin Evans & Dr Emma Shuttleworth, University of Manchester

email: nfm@reading.ac.uk

twitter: @NERC_NFM

web: https://research.reading.ac.uk/nerc-nfm

email: ProtectNFM@manchester.ac.uk

twitter: @ProtectNFM

web: protectNFM.com











Before we start...

Microphones are muted to avoid background noise



Questions



Webinar recording will be available on our website



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Optimising Natural Flood Management in Headwater Catchments to Protect Downstream Communities

WHY HEADWATERS?



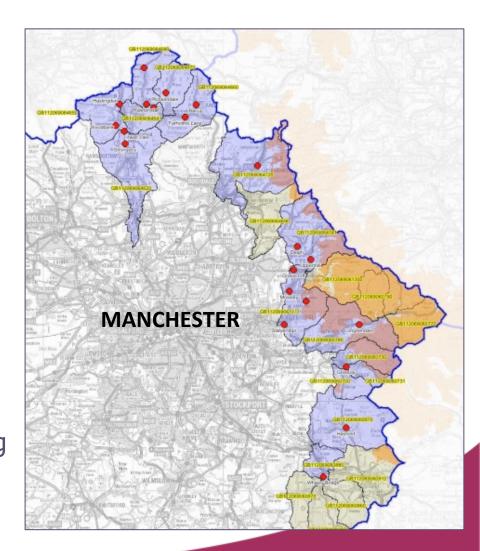
- Demonstrating NFM impacts in large catchments difficult
- Smaller headwater catchments offer unique potential to:
 - develop understanding of changes in runoff processes
 - demonstrate catchment scale benefits
- Upland restoration work funded outside flood defence budgets, not always accounted for in understanding of catchment NFM assets
 - → opportunity to enhance NFM delivery through optimisation of these works for runoff regulation
- Typically areas of extensive agriculture interspersed with wetland
 - → temporary water storage less likely to negatively impact existing land use
- Actively managed landscapes
 - → potential to modify practice to maximise NFM benefits



PROJECT OBJECTIVES



- Derive empirical evidence of the impact of upland restoration and management techniques
- Use this new empirical evidence to build a model suitable for predicting the impact of NFM measures at catchment scale
- Apply the model in headwater catchments draining to
 22 C@R on the eastern edge of Greater Manchester
- Collate data on existing restoration works across the UK with NFM potential and available discharge data and to apply our modelling approaches
- Provide practical and policy guidance on the planning and implementation of headwater NFM applications relevant across the UK uplands



UPLAND PEATLANDS IN THE UK





Peat forming landscapes cover c.60% of upland UK and are highly productive of runoff



UPLAND PEATLANDS IN THE UK



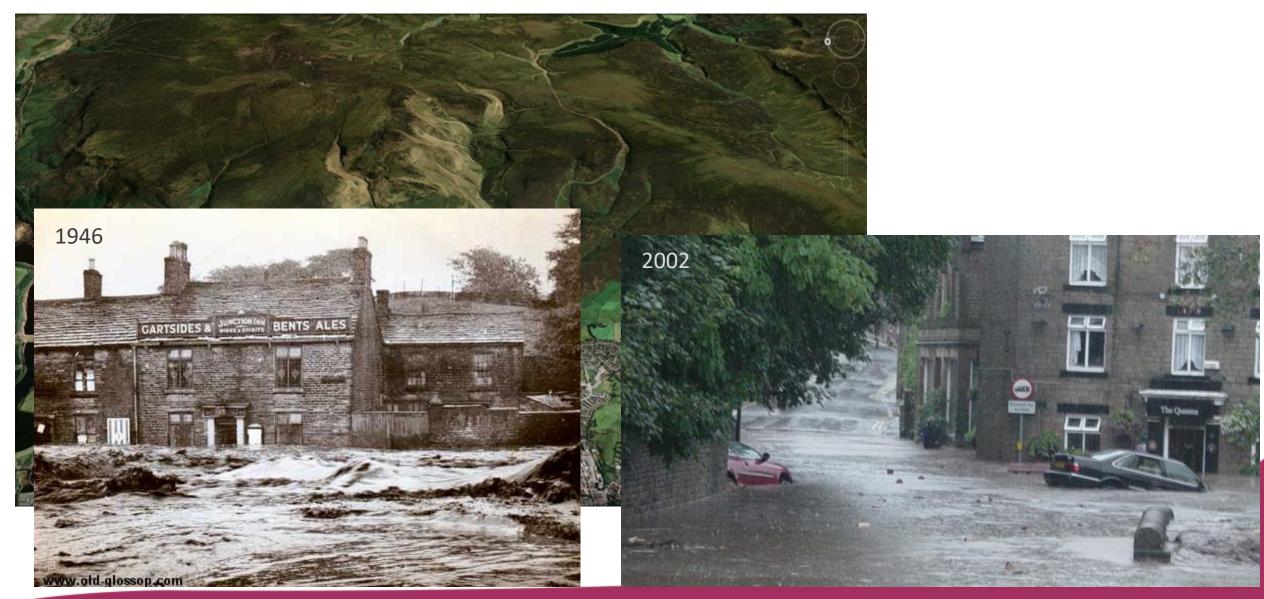


'The Badlands of Britain'
(Tallis, 1997)
Rapid runoff from bare
eroding surface



BLANKET PEAT EROSION AND FLOODING





RESTORATION OF DEGRADED PEATLANDS



- Reseeding with utility grass seed plus lime (Ca CO₃) and fertiliser (NPK)
- Gully Blocking
- Sphagnum planting









RAPID RESTORATION SUCCESS!





How does this impact downstream flood risk?



MAKING SPACE FOR WATER





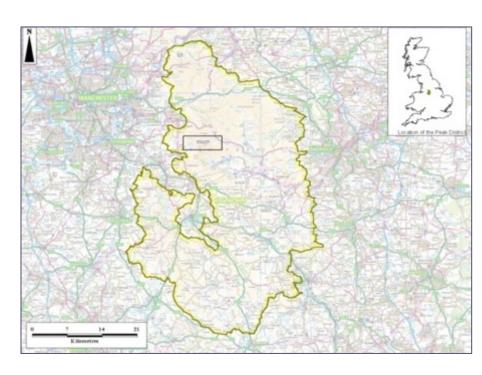


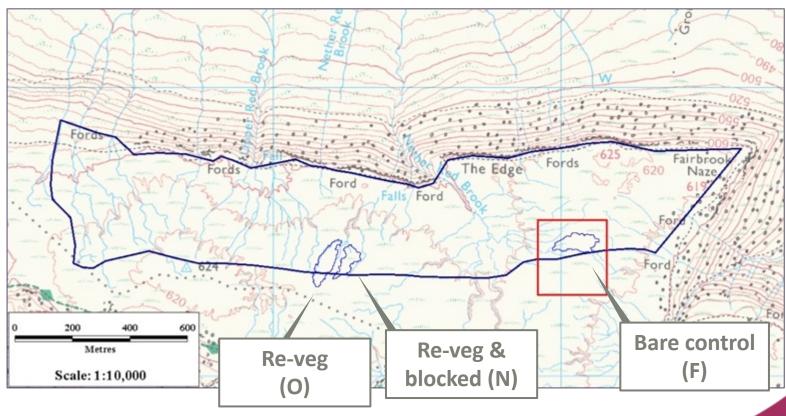
AIM: demonstrate that land management changes in catchments can contribute to the reduction of flood risk and, at the same time, deliver a range of other environmental, social and economic benefits

- Biodiversity
- Sediment production
- Water quality
- Water quantity

RESTORATION ON KINDER EDGE











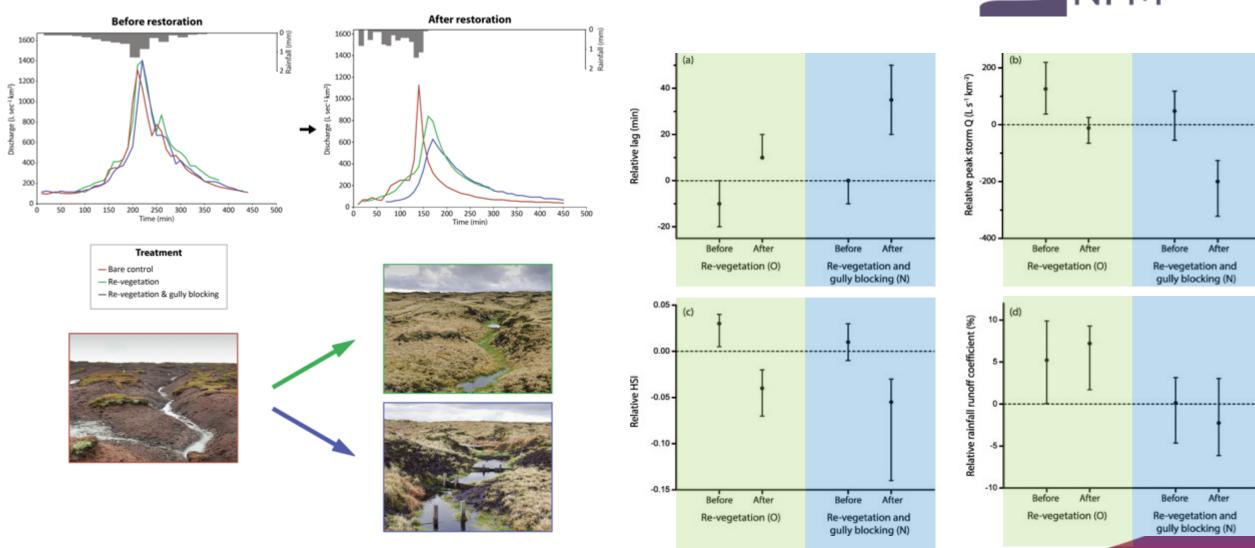
RESTORATION ON KINDER EDGE





EFFECTS OF RE-VEGETATION AND GULLY BLOCKING





Shuttleworth et al (2019) Blanket peat restoration delays flows from hillslopes and reduces peak discharge. *Journal of Hydrology X* - Open Access

Sphagnum reintroduction

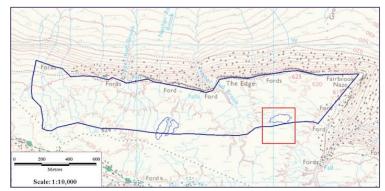


Major aim of moorland restoration work

→ potential to significantly impact downstream runoff

Bare peat sites

- Sphagnum planting is second phase of bare peat re-vegetation
- Using MoorLIFE 2020 Kinder Scout sites
- Nine years of rainfall & runoff data
- 36,000 Sphagnum plugs planted in 2015



Species dominated sites

- Re-establishment of Sphagnum on heather moorlands beneficial for biodiversity and does not negatively impact agricultural uses
- Part of MoorLIFE 2020 on Bleaklow
- Sites established 2017
- Sphagnum planting scheduled for Autumn 2018

SPHAGNUM PLANTING ON PREVIOUSLY BARE SITES











MoorLIFE 2020





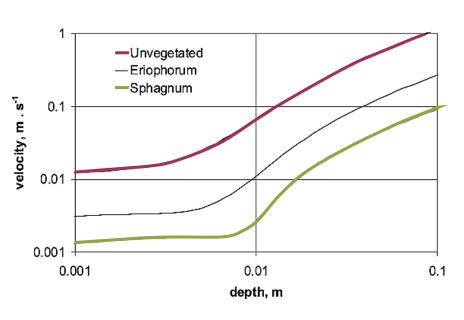




SPHAGNUM and RUNOFF – IN THEORY

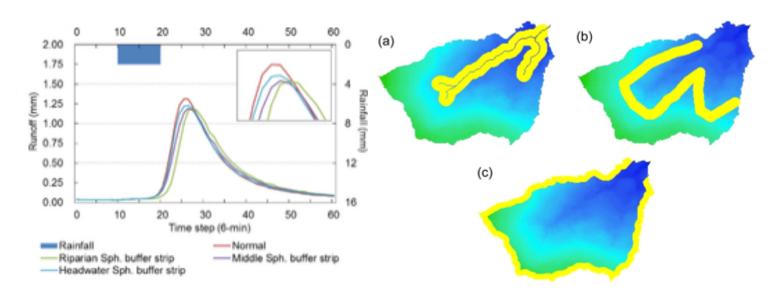


Plot scale experiments



Holden et al (2008)

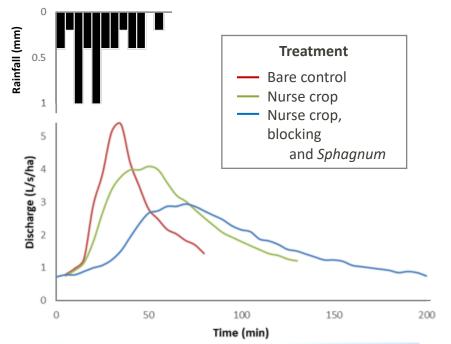
Modelling work



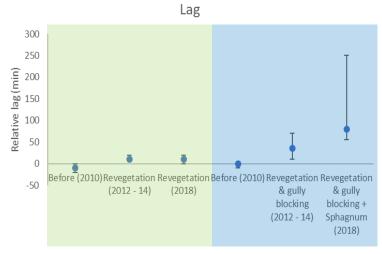
Gao et al (2018)

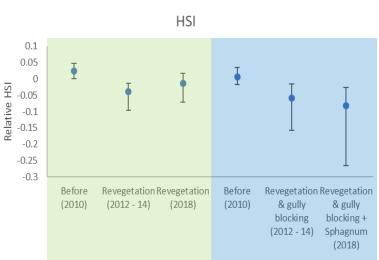
SPHAGNUM and RUNOFF – IN PRACTICE NFM

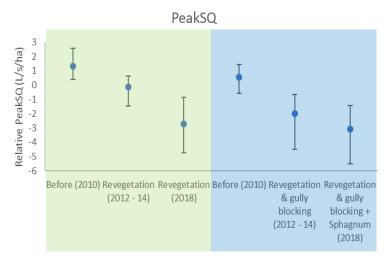


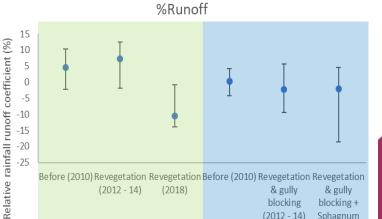












blocking +

(2018)

(2012 - 14) Sphagnum

Gully block design and spacing



Gully blocking aims to stabilise and encourage re-vegetation and raise water tables

→ also reduces peak flows and increases lag times

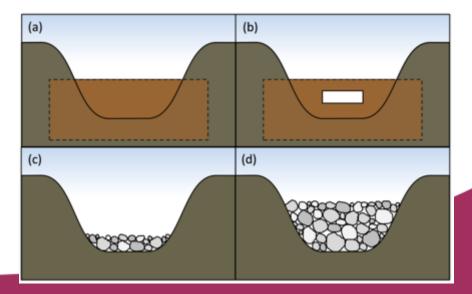
Spacing experiment

- NFM benefits may be driven by roughness from re-vegetation promoted by the blocking
- potential to reduce spacing of dams, and consequently significantly reduce costs



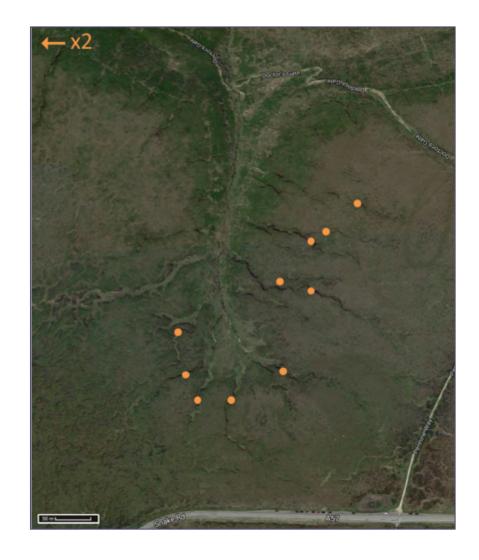
Design experiment

- Builds on MS4W modelling work
- Testing four designs in the field

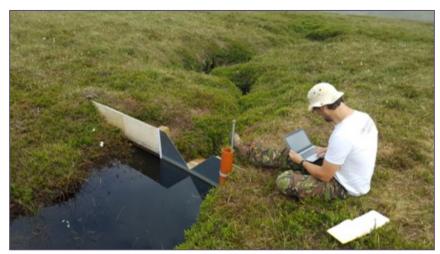


MONITORING AT URCHIN CLOUGH PROTECT NFM











MONITORING AT STALYBRIDGE

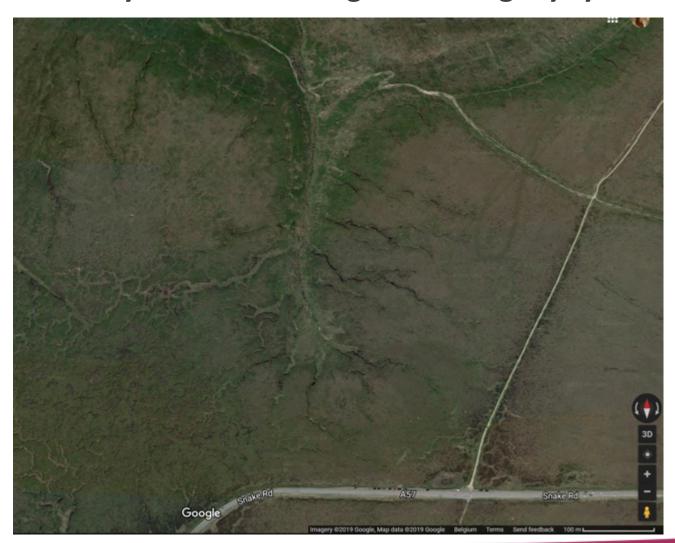




LESSONS FROM BASELINE MONITORING



Variability in natural re-vegetation of gully systems

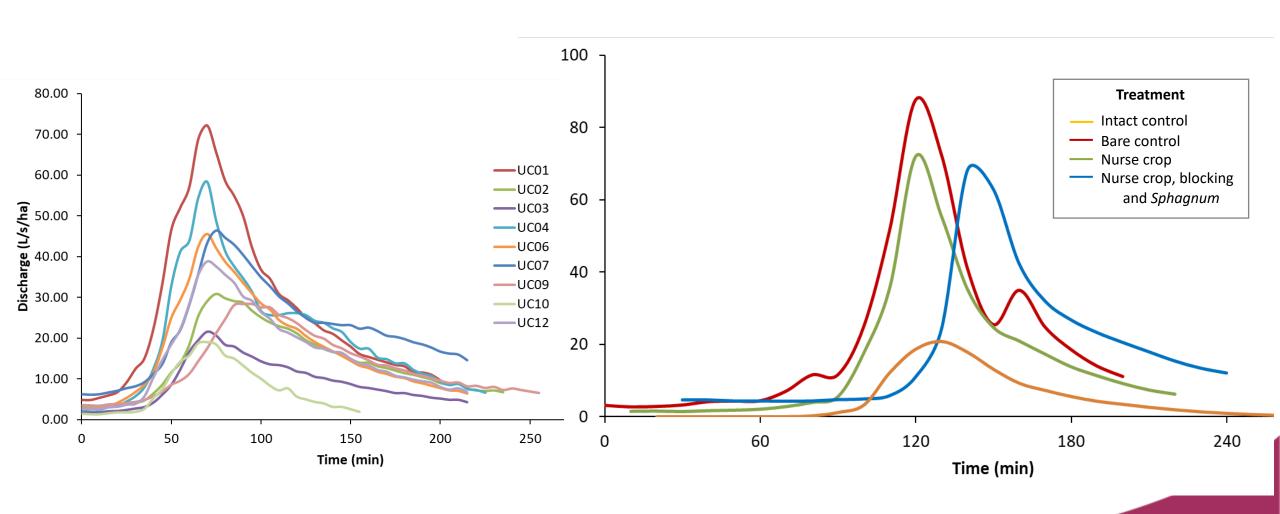






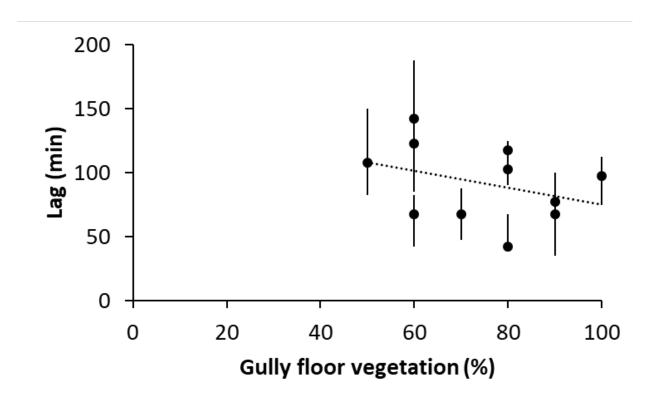
STORM BRONAGH (Sept 2018)

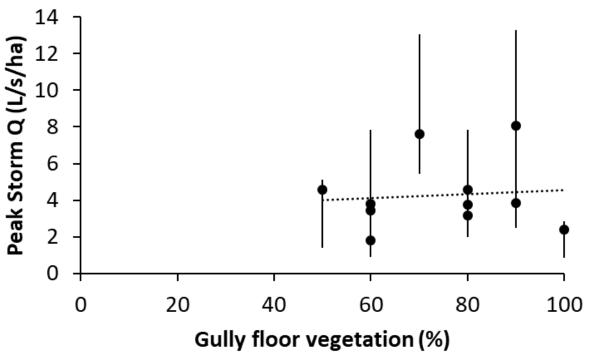




GULLY FLOOR VEGETATION AND RUNOFF

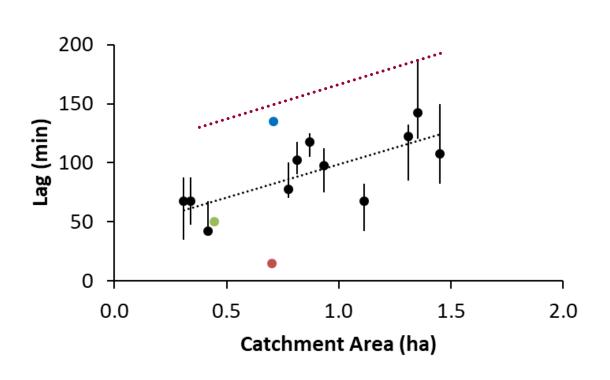


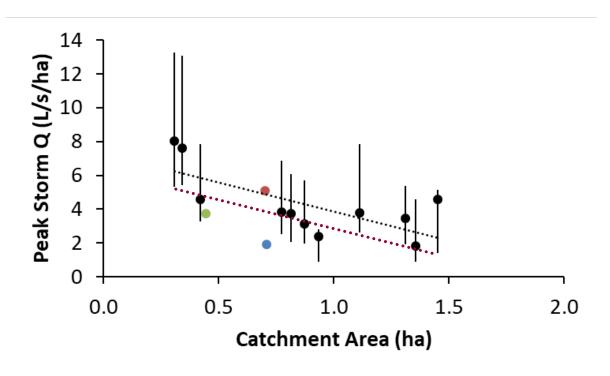




CATCHMENT AREA AND REALISTIC GULLY BLOCKING SCENARIOS













WHAT HAVE WE LEARNT SO FAR? PRO



Restoration of degraded blanket peat by re-vegetation and gully blocking has immediate and significant impacts on stormflow

Increases lag times

Decreases peak flows

But no change in %runoff

→ increased hydraulic roughness is key

Further improvements through time and with addition of *Sphagnum*

More work is needed to pick apart impact of Sphagnum from maturing gully blocks

Naturally recovering systems have highly variable stormflow responses

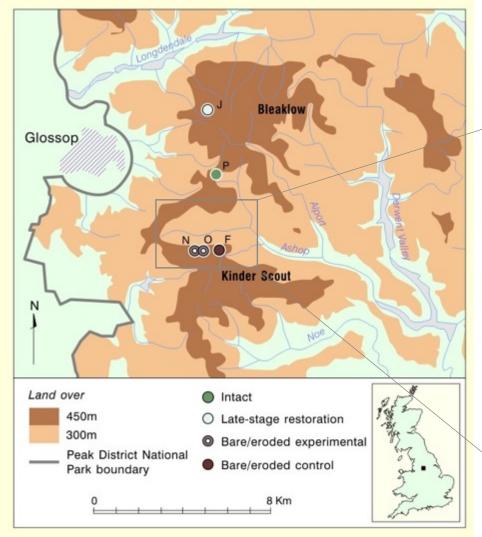
No relationship between gully floor vegetation and stormflow metrics

→ Re-vegetation is important in slowing the flow across hillslopes Gully blocking is important in slowing the flow in channels

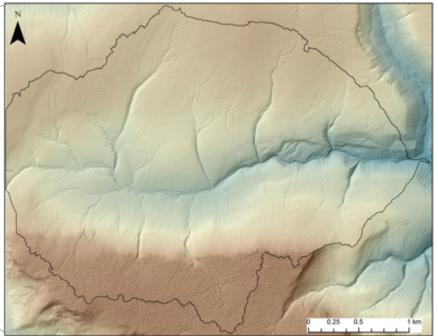
Gully blocking has the potential to further attenuate flow in naturally recovering systems

DOES IT WORK AT MEANINGFUL SCALES?



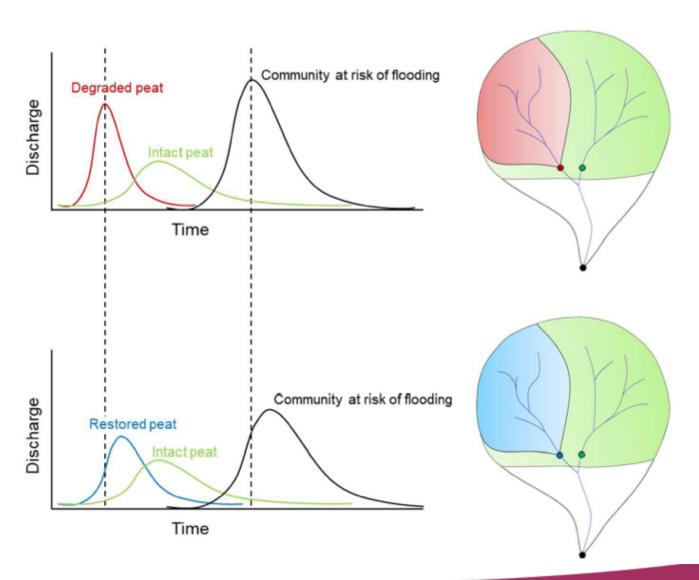


Upper Ashop catchment: 9 km² ~17 % gullied peat
Micro-catchments (N,O,F,P): ½ ha



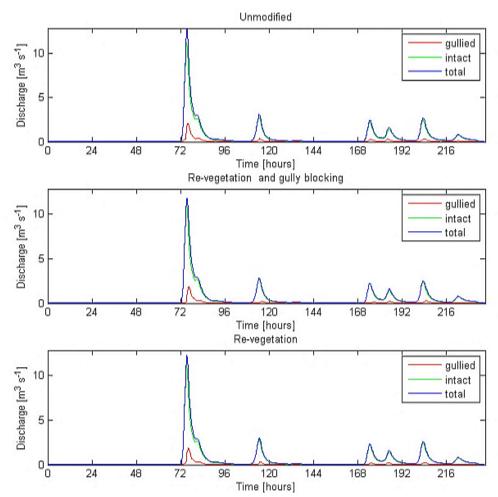
CONCEPTUAL BASIS FOR NFM IN PEAT CATCHMENTS





DOES IT WORK AT MEANINGFUL SCALES?





- Upscaling from ½ ha to 9 km² with 12% of the catchment modified we find that :
 - re-vegetation alone reduces peak discharge by up to 5
 - re-vegetation & gully blocking reduces peak discharge by up to 8 %, PERHAPS EXPECT AT LEAST 2-4%
 - complete recovery might reduce peak discharge by up to 10 %.
- The results are somewhat sensitive to assumed overland flow and channel velocities, these can be calibrated to reduce the uncertainty.

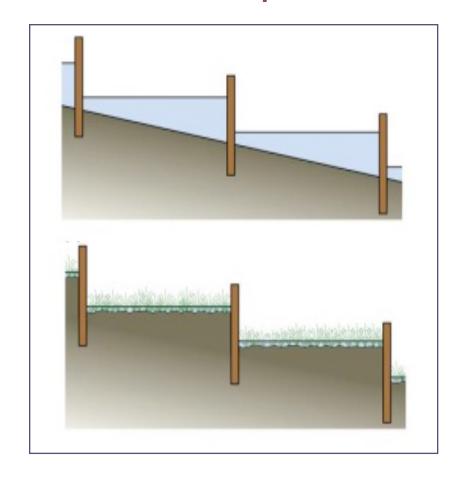


MAKING SPACE FOR WATER

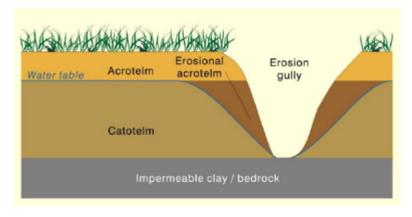
ONGOING MONITORING WORK PROTECT



Long term sustainability of NFM impacts



Gully edge hydrology



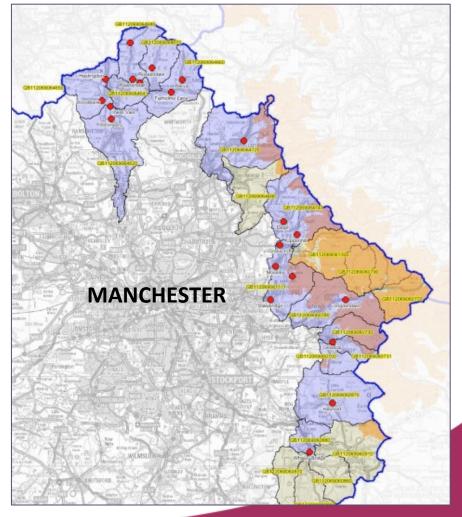
Woodland planting



ONGOING MODELLING WORK PROTECT NFM







COMING SOON...





Peatland Catchments and Natural Flood Management

Report to the IUCN UK Peatland Programme's Commission of Inquiry on Peatlands Update

Tim Allott¹, Jorge Auñón², Christian Dunn³, Martin Evans¹, Jill Labadz⁴, Paul Lunt⁵, Michael MacDonald⁶, Tom Nisbet⁷, Roger Owen⁸, Mike Pilkington², Sarah Proctor⁹, Emma Shuttleworth¹, Jon Walker¹⁰

¹University of Manchester, ²Moors for the Future Partnership, ³Bangor University, ⁴Nottingham Trent University, ⁵University of Plymouth, ⁶Royal Society for the Protection of Birds, ⁷Forest Research, ⁸Scottish Environmental Protection Agency, ⁹IUCN UK Peatland Programme, ¹⁰Swansea University

August 2019



Commons Select Committee



State of peatland in England inquiry launched



Papers in draft
Model development
Natural variability































Thanks for listening! Any questions?





And finally...

- Feedback and follow up questions please email us
- Recording available on website
- Next webinar: 27 November, 'Farmers and Soil Management' with Niels Corfield - registration open
- Newsletter sign up on website







email: nfm@reading.ac.uk

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