Peatland hydrology in boreal Sweden:

Experimental rewetting

Shirin Karimi

SLU SMHI

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15 October

What is peatland?

- Peatlands are landscapes that form in waterlogged anaerobic conditions, where the rate of accumulation (1 mm per year) exceeds the rate of decomposition (Joosten, 2016)

- Peat is primarily composed of partially decomposed plant matter, typically sphagnum moss

Peatland hydrology

- **High porosity (80%)**
- **Low bulk density**

High water storage capacity

Drought resilience & flood buffering

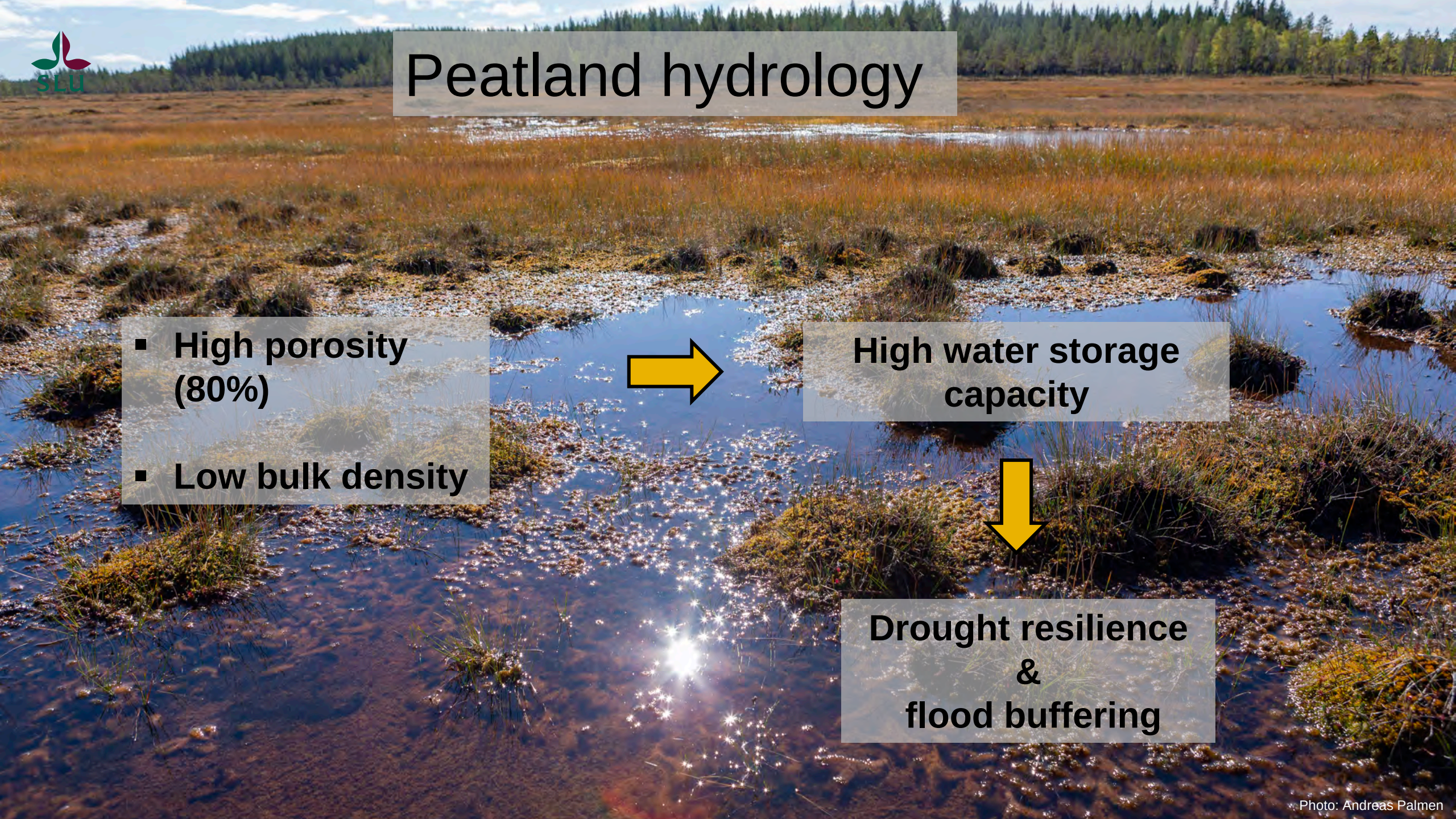

Photo: Andreas Palmen

Peatland drainage

In **Sweden** peatland drainage has been practiced since the early 18th century for agricultural purposes and the early 19th century for forest production.

Hydrol. Earth Syst. Sci., 16, 2299–2310, 2012
www.hydrol-earth-syst-sci.net/16/2299/2012/
doi:10.5194/hess-16-2299-2012

Hydrology and Earth System Sciences

Effects of peatland drainage management on peak flows

C. E. Ballard[1,2], N. McIntyre[1], and H. S. Wheater[1,3]

[1]Department of Civil and Environmental Engineering, Imperial College London, London SW7 2AZ, UK
[2]Aqualinc Research Ltd, 11 Deans Avenue, Christchurch, 8011, New Zealand
[3]Canada Excellence Research Chair in Water Security, University of Saskatchewan, National Hydrology Research Centre, 11 Innovation Boulevard, Saskatoon, Saskatchewan S7N 3H5, Canada

Correspondence to: C. E. Ballard (c.ballard@aqualinc.co.nz)

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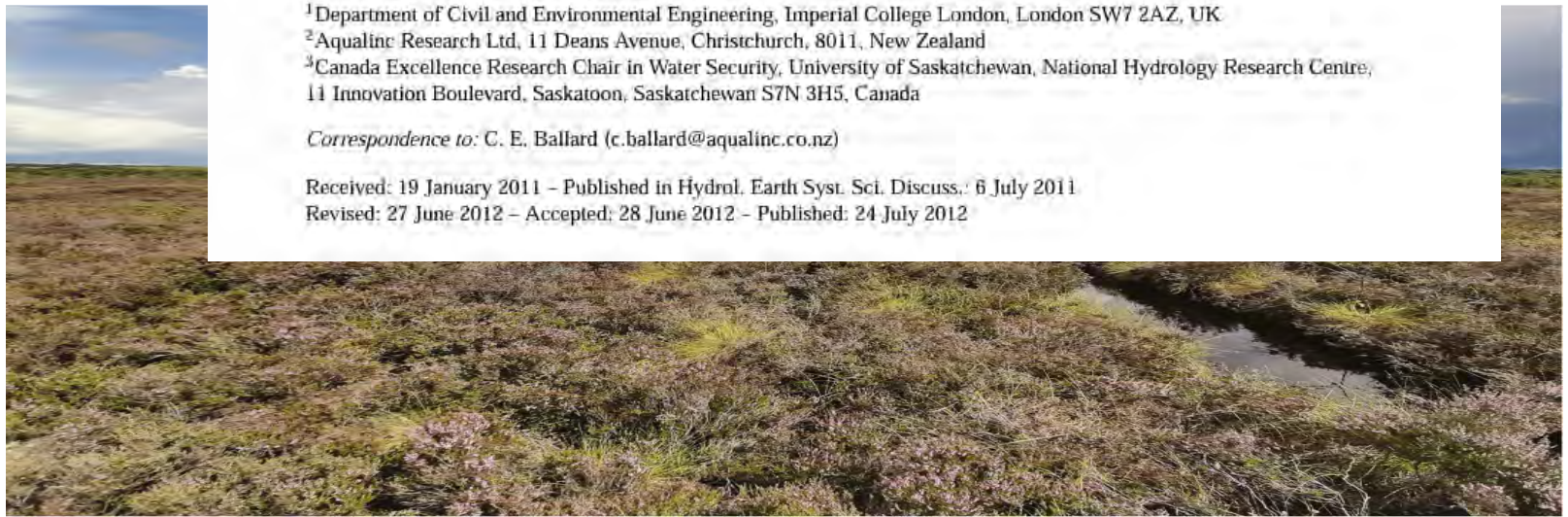

Rewetting drained peatlands as natural climate solutions?

Journal of Hydrology X
Volume 2, January 2019, 100006

Research papers

Restoration of blanket peat moorland delays stormflow from hillslopes and reduces peak discharge

Emma L. Shuttleworth [a], Martin G. Evans [a], Michael Pilkington [b], Thomas Spencer [b], Jonathan Walker [c], David Milledge [d], Timothy E.H. Allott [a]

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Peatland restoration increases water storage and attenuates downstream stormflow but does not guarantee an immediate reversal of long-term ecohydrological degradation

Naomi Gatis, Pia Benaud, Karen Anderson, Josie Ashe, Emilie Grand-Clement, David J. Luscombe, Alan Puttock & Richard E. Brazier

Scientific Reports 13, Article number: 15865 (2023) | Cite this article

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10.1029/2024WR037320

Special Collection:
Quantifying Nature-based Climate Solutions

Natural Flood Management Through Peatland Restoration: Catchment-Scale Modeling of Past and Future Scenarios in Glossop, UK

Salim Goudarzi[1], David Milledge[2], Joseph Holden[3], Martin Evans[4], Tim Allott[4], Adam Johnston[4], Emma Shuttleworth[4], Martin Kay[4], David Brown[5], Joe Rees[4], Donald Edokpa[4], and Tom Spencer[6]

[1]School of Geosciences, University of Aberdeen, Aberdeen, UK, [2]Department of Civil Engineering, Newcastle University, Newcastle Upon Tyne, UK, [3]Water@leeds, School of Geography, University of Leeds, Leeds, UK, [4]Department of Geography, University of Manchester, Manchester, UK, [5]Greater Manchester, Merseyside and Cheshire Environment Agency, Manchester, UK, [6]Moors for the Future Partnership, Manchester, UK

Key Points:

- At catchment scale, it is not necessary (nor feasible) to delay the flood-wave to meaningfully attenuate it at the outlet
- Deferring only a portion of the flood volume to the receding limb can be sufficient for meaningful flood risk

NATURVÅRDSVERKET

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Bidrag för att anlägga, återväta eller restaurera våtmarker

Granskad: 20 juni 2023

Det finns över 10 olika stöd och bidrag att söka för olika våtmarksprojekt. Flera bidrag kan användas till både förstudier och arbete ute i fält. Här har vi samlat dem utifrån vem som söker.

För 2024 är Naturvårdsverkets anslag 355 miljoner kronor för olika våtmarksinsatser. Majoriteten av dessa medel fördelas vidare till Länsstyrelserna och Skogsstyrelsen.

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Markägare ersätts för att återväta torvmark

Skogsägare kan få ersättning för att återväta utdikad torvmark. Framför allt i södra och mellersta Sverige. Skogsstyrelsen sköter allt praktiskt.

Anmäl intresse ›

Photo: Andreas Palmen

Knowledge gaps

- The impact of peatland restoration on hydrological functions across peatland types, regions and scales is largely unknown – fen, bog , etc.
- Conflicting conclusions in previous studies
- Empirical data and practical recommendations in a Swedish context are limited and mostly come from research in **Finland**, the **UK** and **Canada** (Bring et al., 2022).

The case study at the Trollberget Experimental Area (TEA)

Before-After Control-Impact (BACI)

- An oligotrophic minerogenic fen
- 5 transects with 6 dipwells in each
- Control catchment: Degerö Stormyr (64° 10′ N, 19° 33′ E)

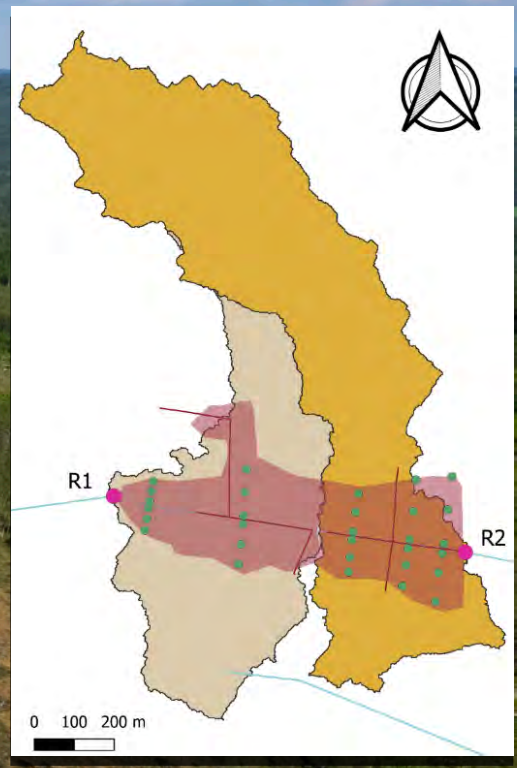

Photo: Andreas Palmen

Restoration activities

- Rewetting was done in November 2020
- Sparse tree cover was cut
- Ditches were blocked using peat and tree logs

Photo: Andreas Palmen

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Journal of Hydrology
Volume 641, September 2024, 131729

Research papers

Rewetting impact on the hydrological function of a drained peatland in the boreal landscape

Shirin Karimi, Eliza Maher Hasselquist, Shokoufeh Salimi, Järvi Järveoja, Hjalmar Laudon

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https://doi.org/10.1016/j.jhydrol.2024.131729

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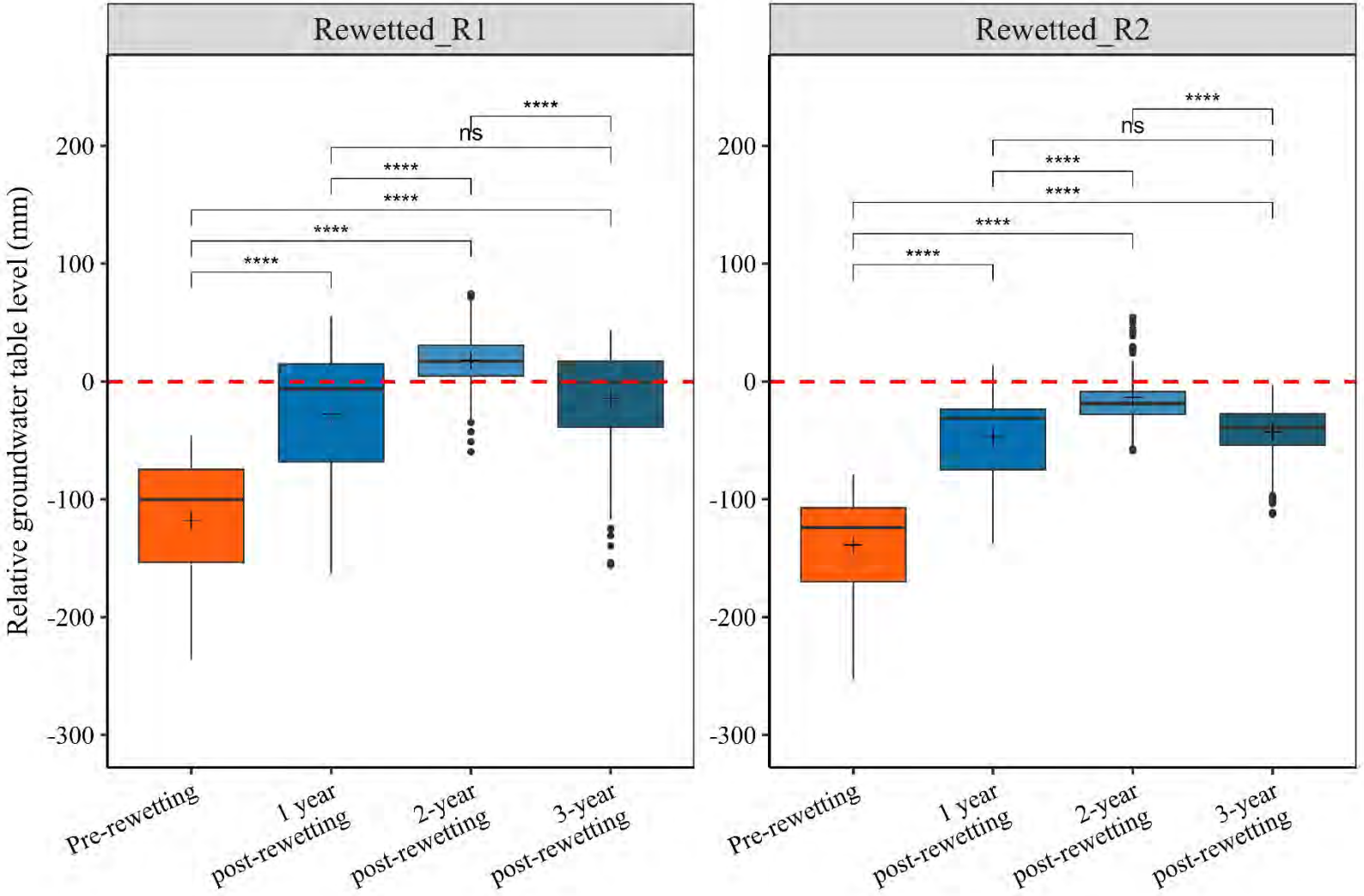
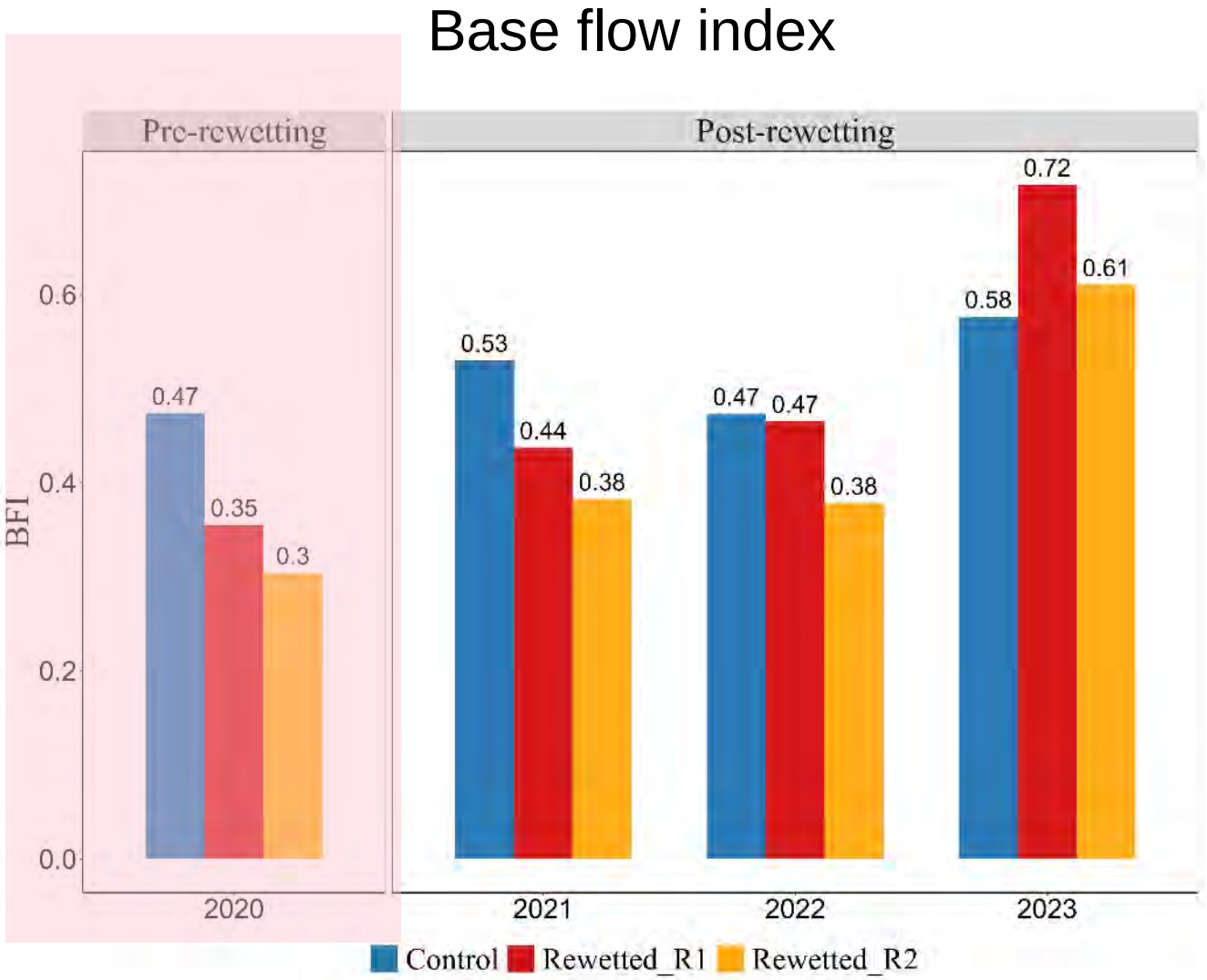
Effect of rewetting on groundwater storage



Effect of rewetting on base flow

BFI

R1: 105%
R2: 103 %
Control: 23%



https://doi.org/10.5194/hess-2024-158
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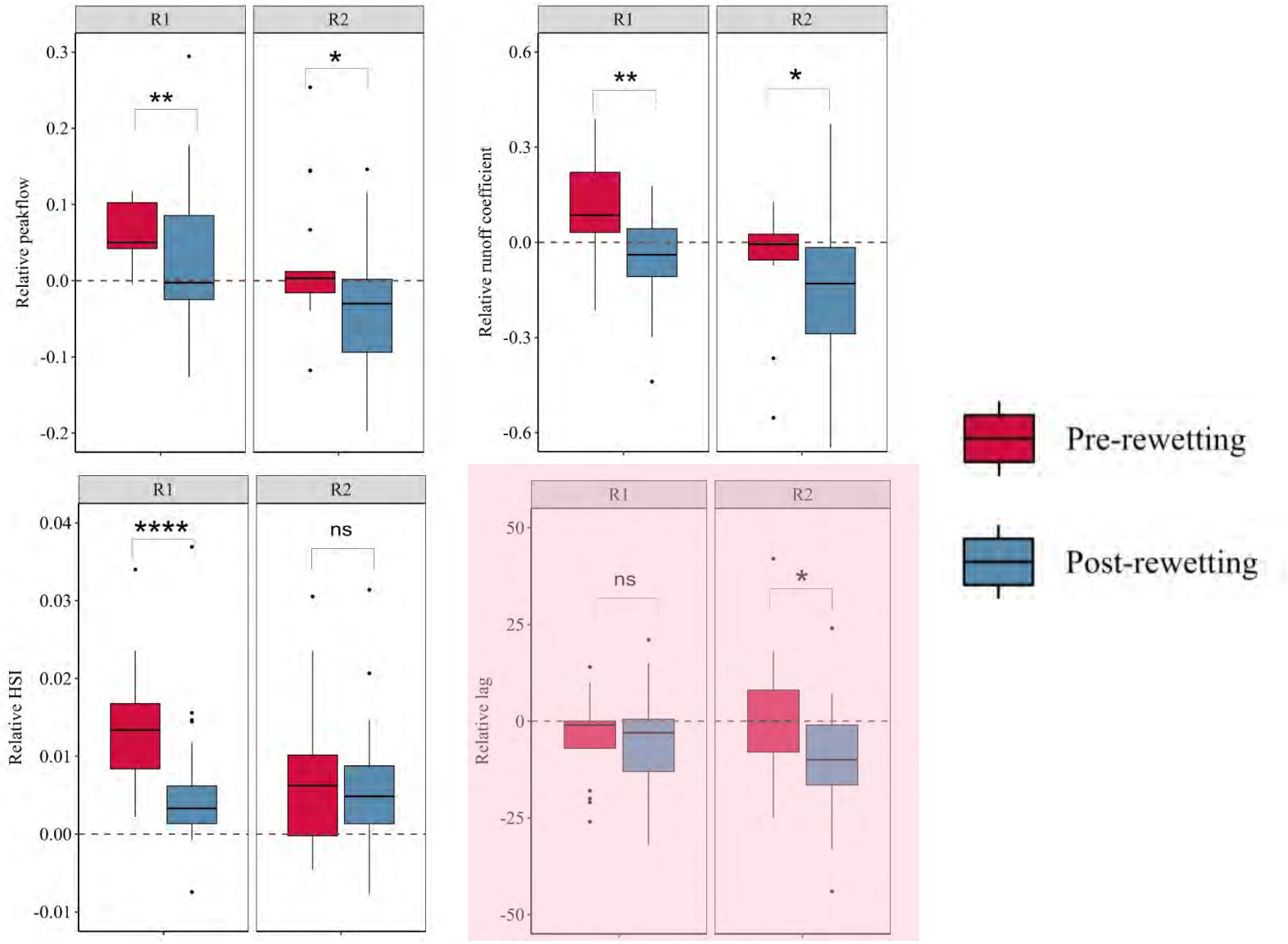
Does peatland rewetting mitigate extreme rainfall events?

Shirin Karimi[a], Eliza Maher Hasselquist[a], Järvi Järveoja[a], Virginia Mosquera[a], and Hjalmar Laudon[a]

[a] Swedish University of Agricutural Sciences, Department of Forest Ecology and Management, Umeå, Sweden

*Corresponding author: shirin.karimi@slu.se

Flood mitigation effects of rewetting



Conclusions

- Hydrological functioning of the peatland is progressing towards a more natural state, characterized by a higher and more stable water table, higher base flow and enhanced storage capacity.

- Rewetting led to flood attenuation by significantly reducing peak flow, runoff coefficients, and hydrograph flashiness.

Photo: Andreas Palmen

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Hydrology and Earth System Sciences
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Where can rewetting of forested peatland reduce extreme flows?

Maria Elenius[1*], Charlotta Pers[1], Sara Schützer[1], Berit Arheimer[1]

[1]Hydrological Research Unit, SMHI, Norrköping, 601 76, Sweden
[*]Present address FOI, Linköping, 583 30, Sweden

Correspondence to: Maria Elenius (maria.elenius@foi.se)

National rewetting impacts on discharge extremes

Rewet 1 = ditch removal

Rewet 2 = ditch removal+ tree removal

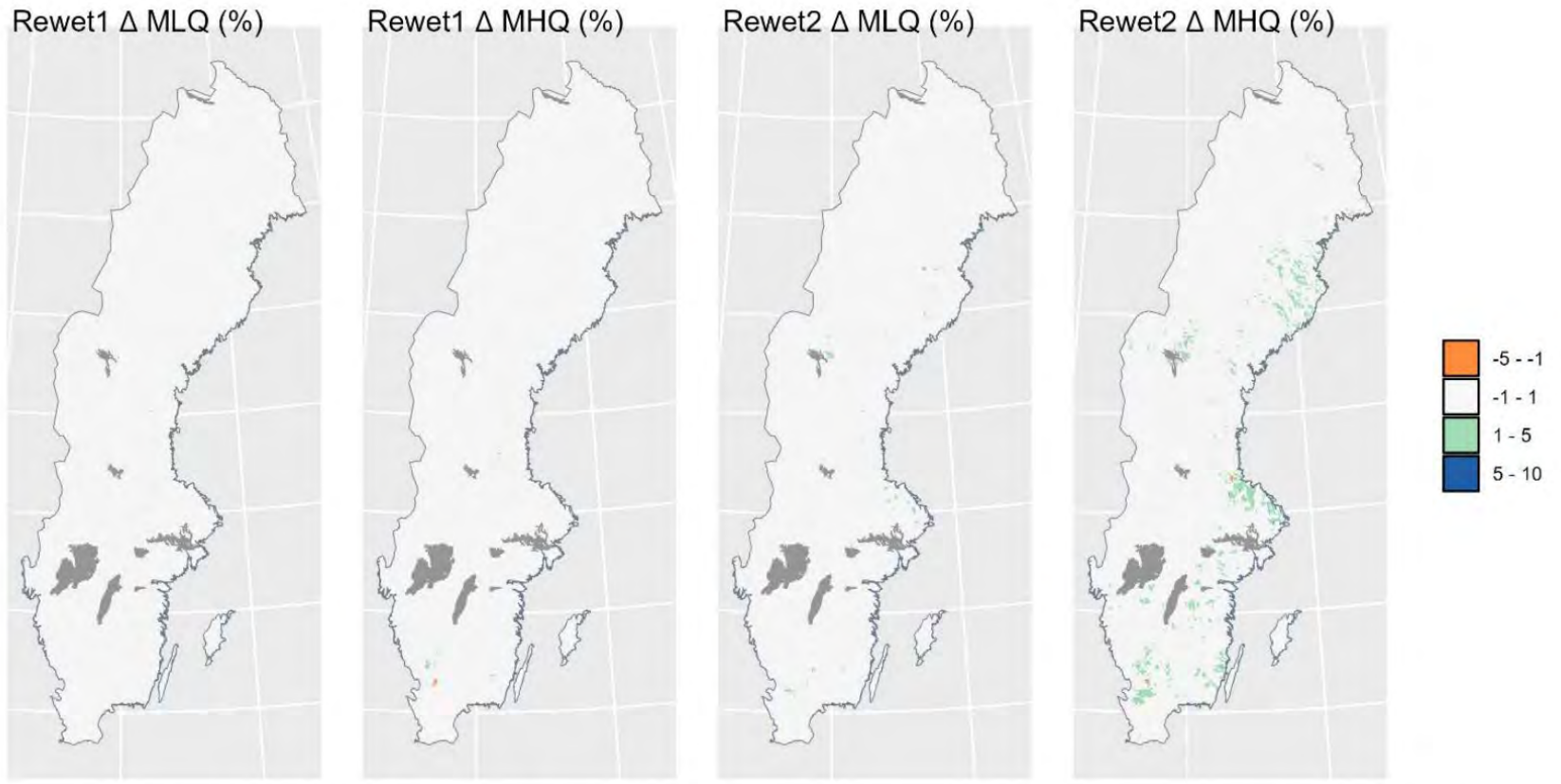


Figure 2: Relative changes (%) in the average minimum (MLQ) and maximum (MHQ) yearly discharge, over the study period 2012-2021. Forested peatland and fens were rewet.

Minimum groundwater levels and runoff

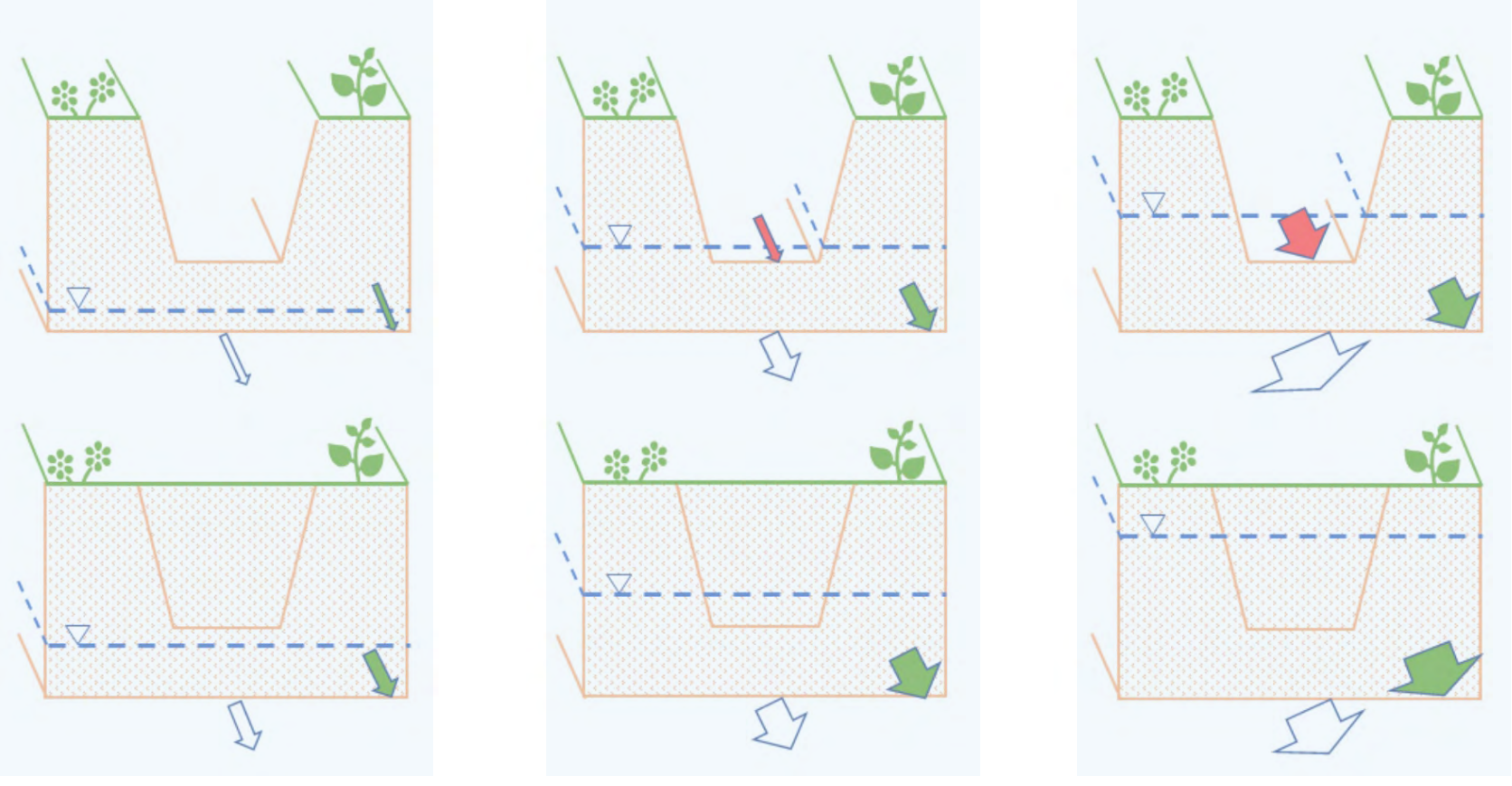
Total runoff

Ditch runoff

Soil runoff

Drained

Rewetted



Conclusions

- The study found that while localized impacts of rewetting can be significant in peatland streams, the overall effects on discharge extremes at larger scales are limited due to the mixing of runoff from various land cover types.

- Groundwater levels prior to rewetting and reduced tree cover were identified as crucial factors affecting runoff. This emphasizes the need for careful site selection and management practices when implementing rewetting strategies to maximize their effectiveness in mitigating floods and droughts.

Thank you for your attention!

shirin.karimi@smhi.se

Supervisors:
Hjalmar Laudon
Eliza Maher Hasselquist
Jan Seibert
Kevin Bishop