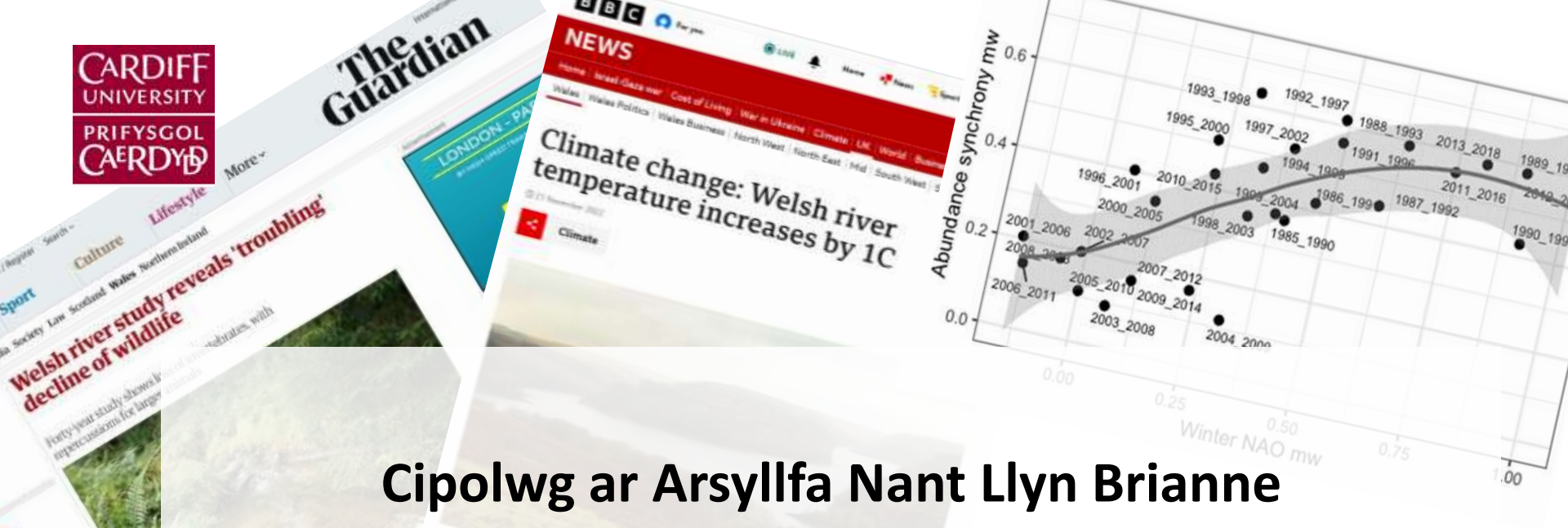
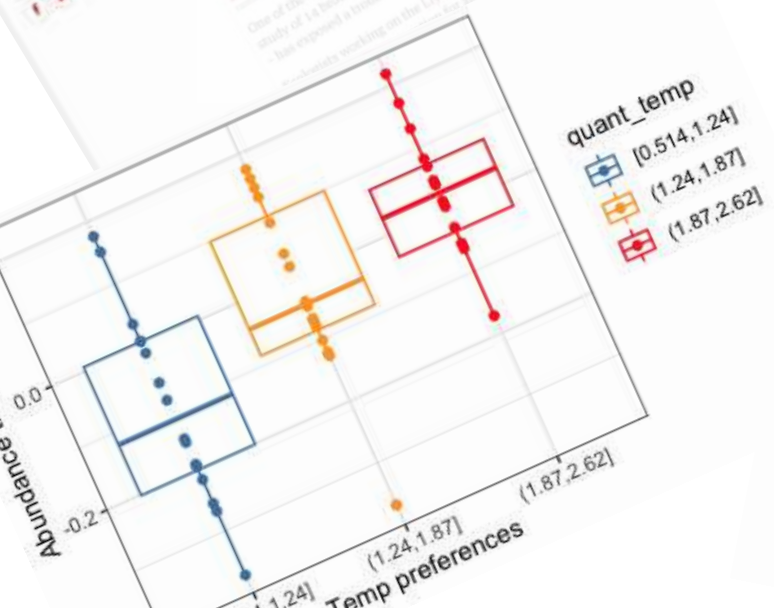
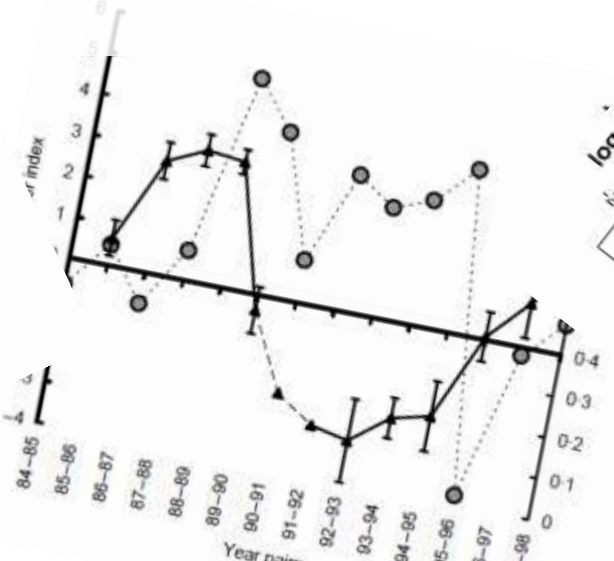
Cipolwg ar Arsyllfa Nant Llyn Brianne

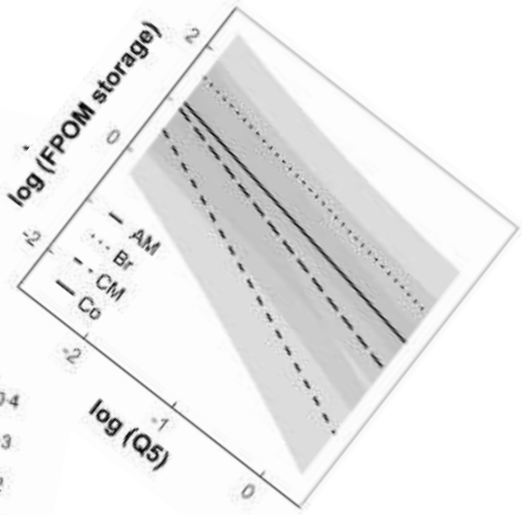
Insights from the Llyn Brianne Stream Observatory

Steve Ormerod









1. Arddangos agweddau arbrofol/ymchwiliol posibl tuag at ddeall a rheoli problemau ar raddfa ddalgylchol

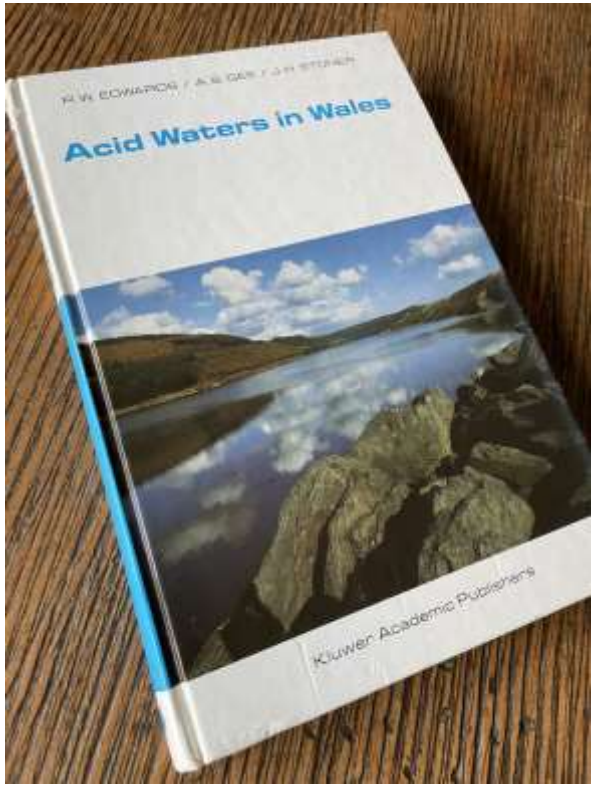
2. Amlygu sut y gall partneriaid o wahanol ddisgyblaethau a sefydliadau gydweithio

3. Dangos y gwerth a'r addysgu hir-dymor all ddeillio o'r fath gynllun.

1. Demonstrate a potential experimental/investigative approach to understanding and managing catchment-scale problems

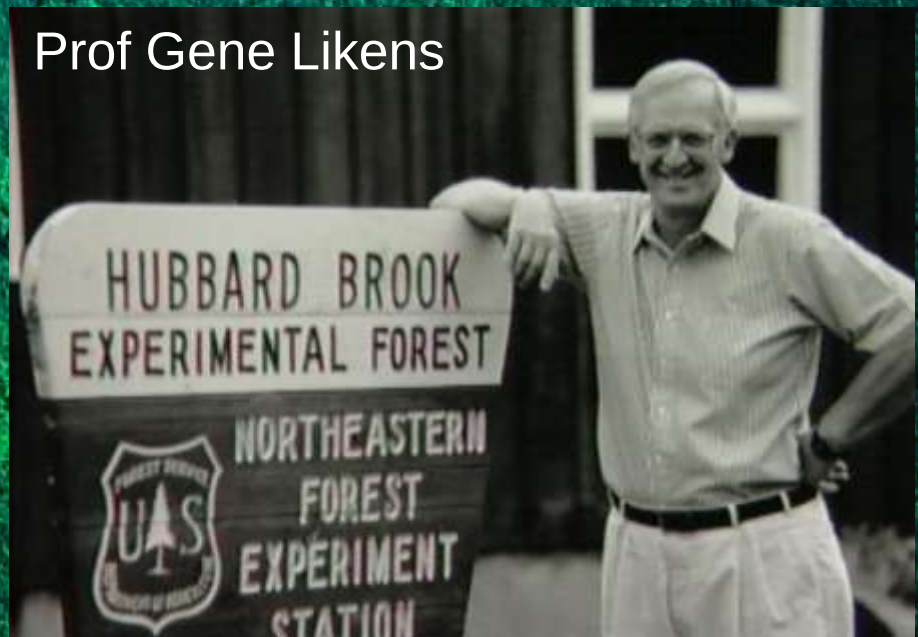
2. Illustrate partners from different disciplines and organisations working together

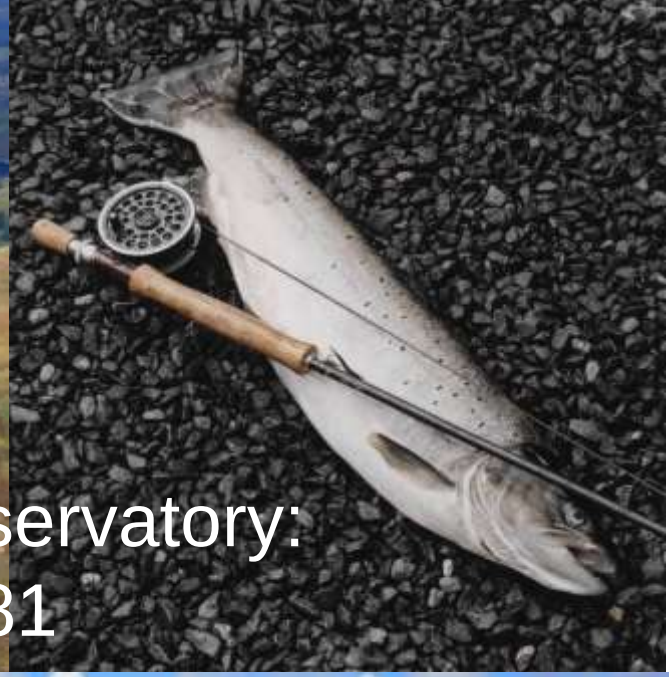
3. Show the long-term learning and value that can result








Prof Gene Likens
HUBBARD BROOK
EXPERIMENTAL FOREST
NORTHEASTERN
FOREST
EXPERIMENT
STATION



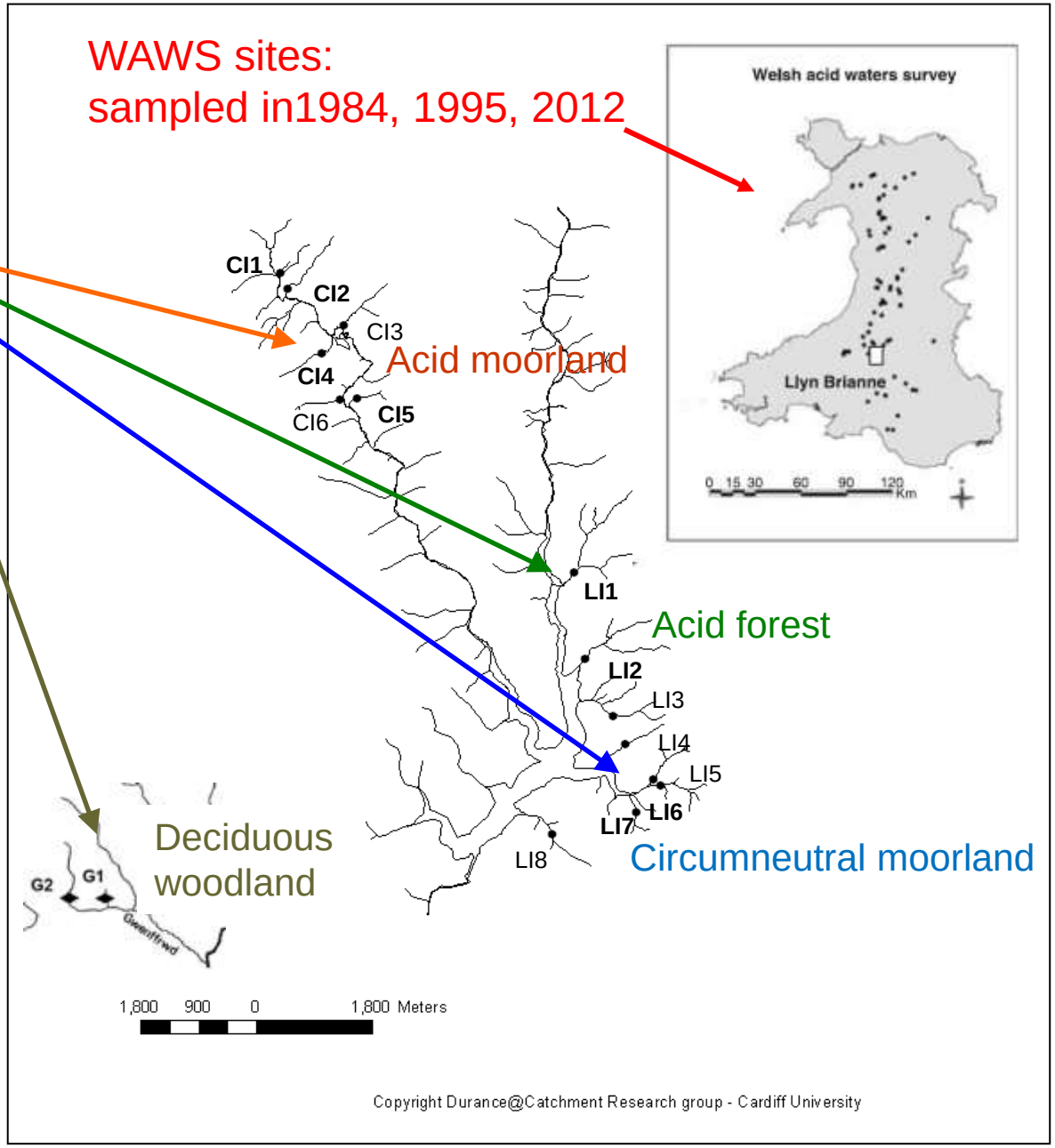
Lynn Brianne Stream Observatory: Established in 1981

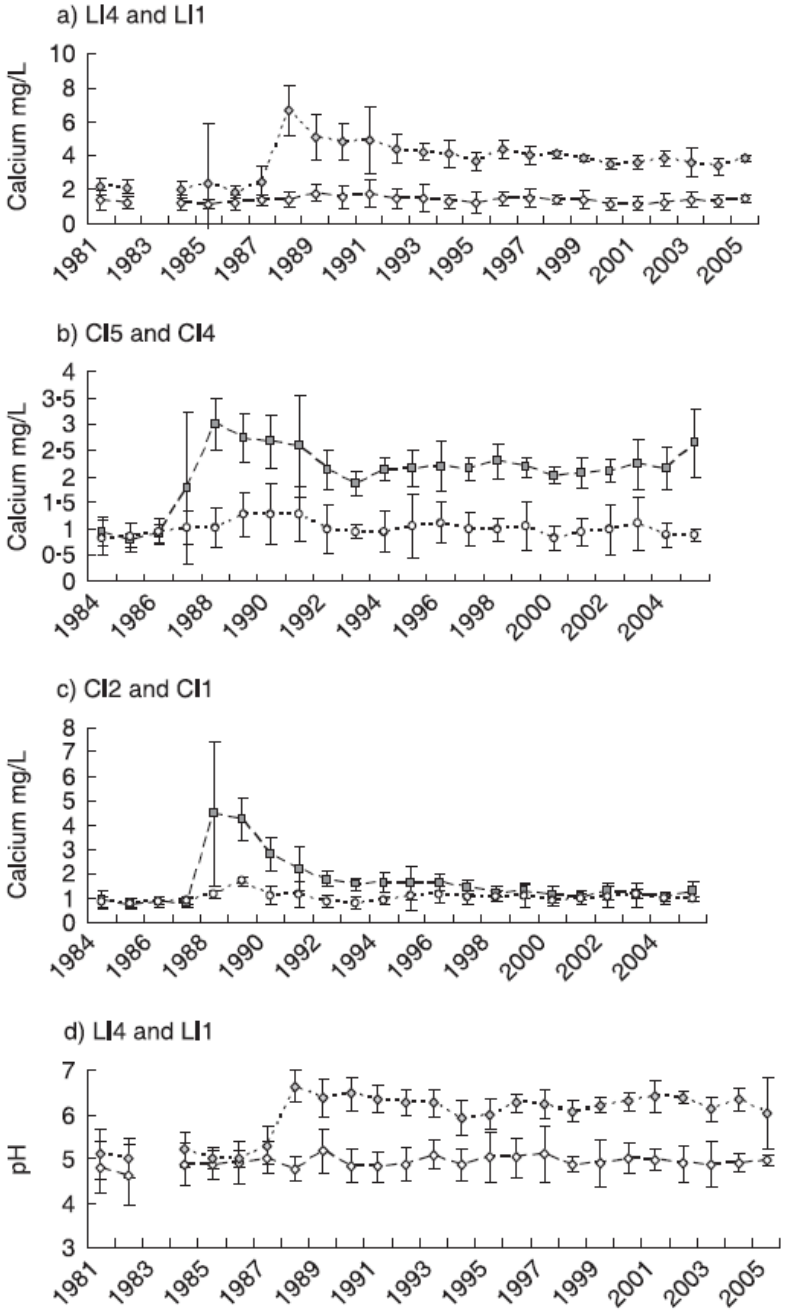
Conifers in high altitude areas increased S and N deposition by 50-80%: base-poor streams were more acid under conifers

Reference catchments in different land-use

The Llyn Brianne Stream Observatory….

…. established in ***1981*** to assess the role of land use in acidification – but also to test predicitons about recovery using ***<u>replicated</u> catchment experiments.***





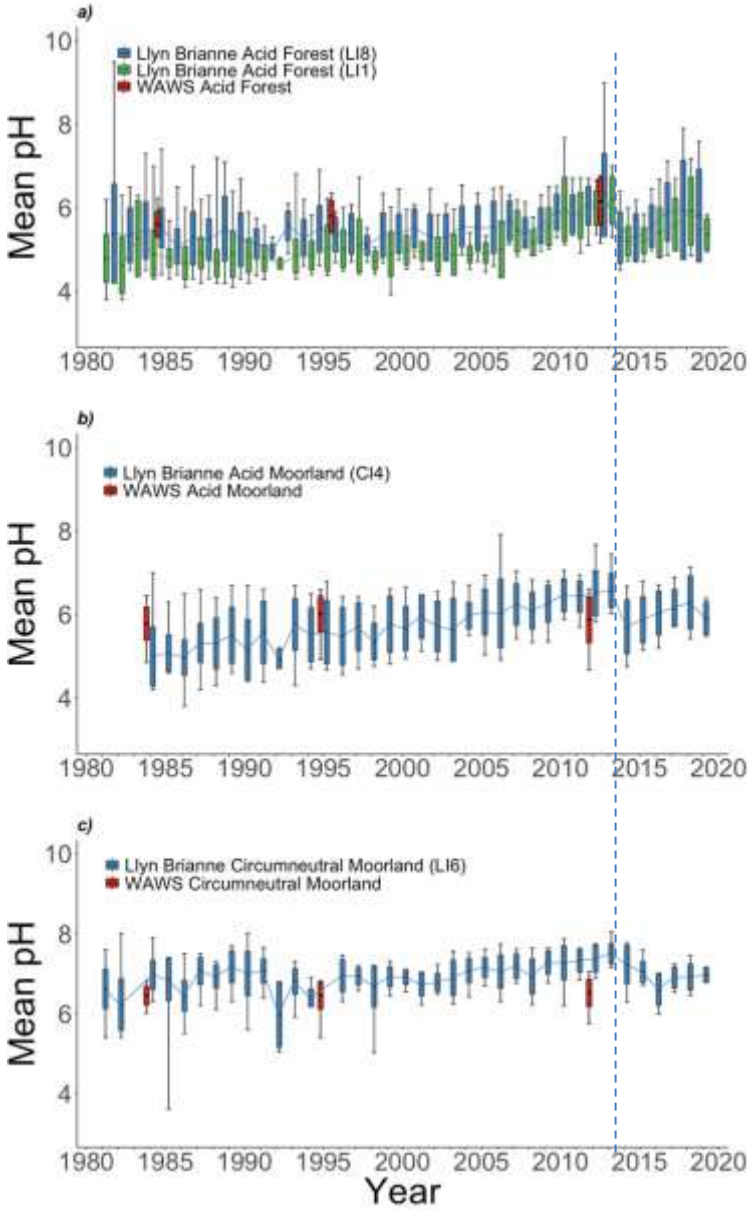
Effect of catchment liming on stream calcium and pH: B-A-C-I design

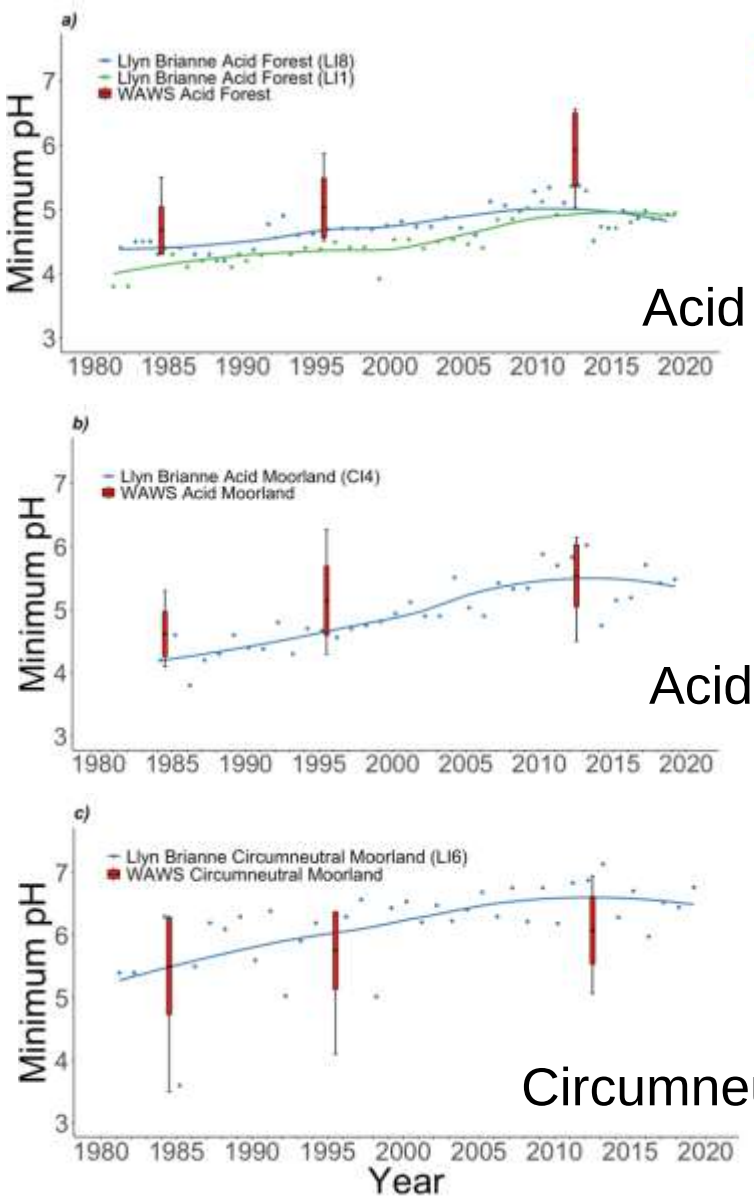
(Before-After Control-Intervention)

Importance of **counterfactual**

((Ormerod & Durance 2009)

Mean and minimum pH at Llyn Brianne and across Wales (red bars) in ‘reference’ streams 1981-2020





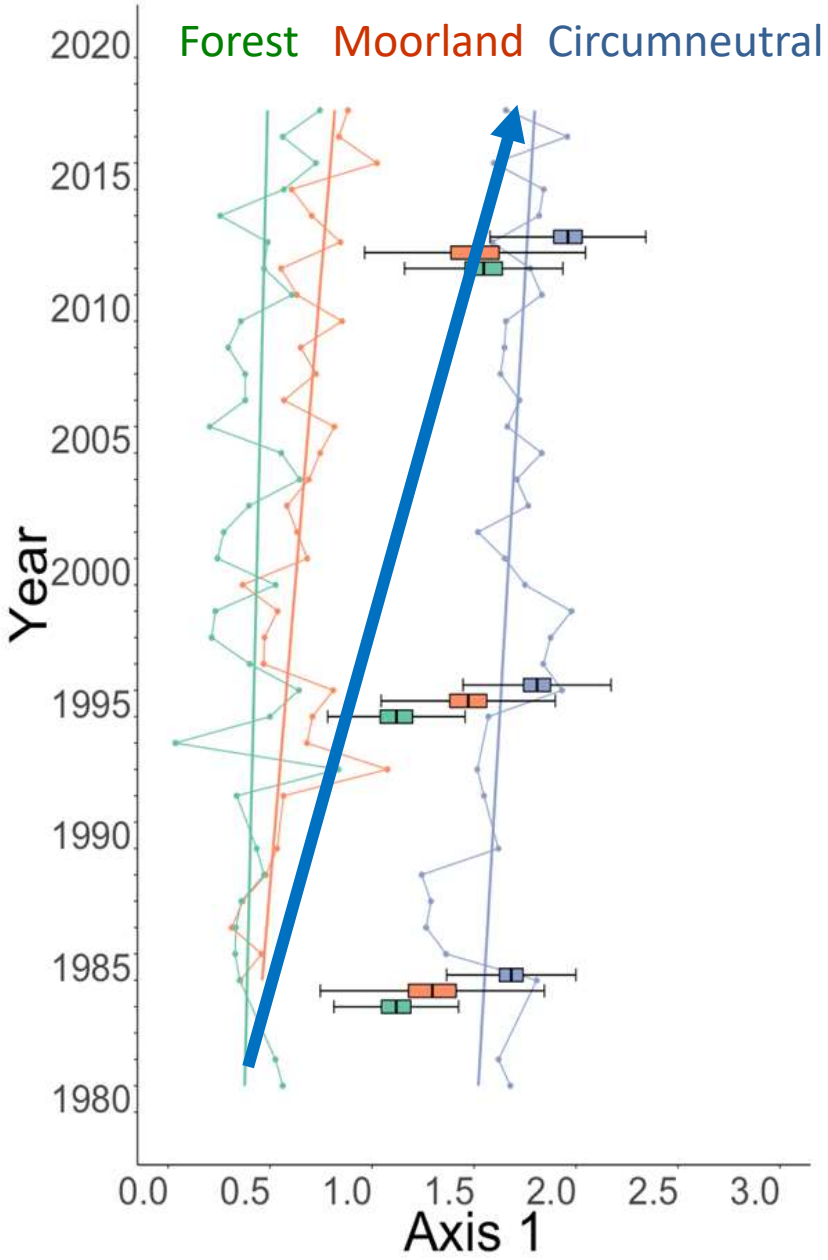
Cyfoeth Naturiol Cymru
Natural Resources Wales

Acid forest

Acid moorland

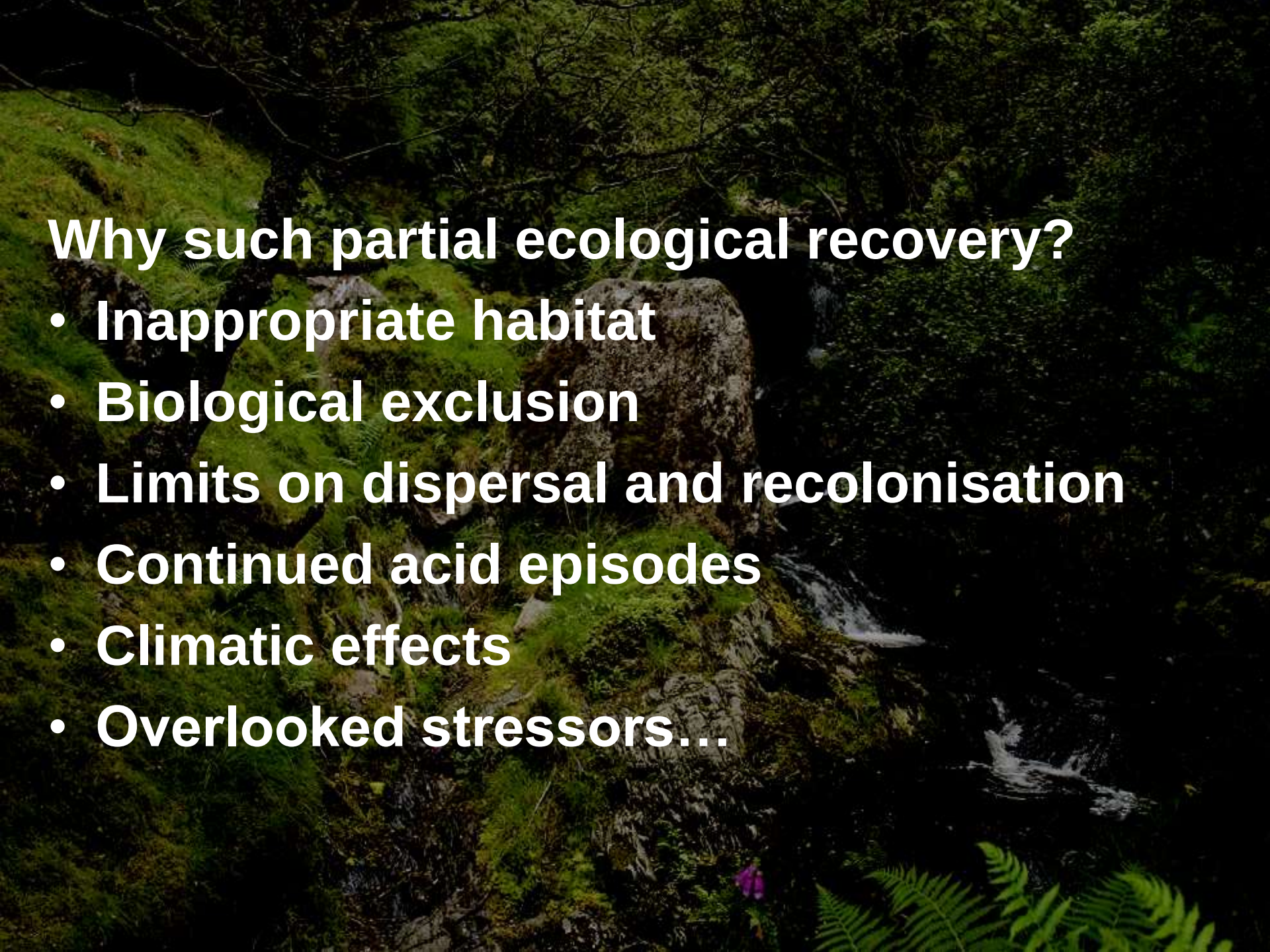
Circumneutral reference

Alex Carr et al.



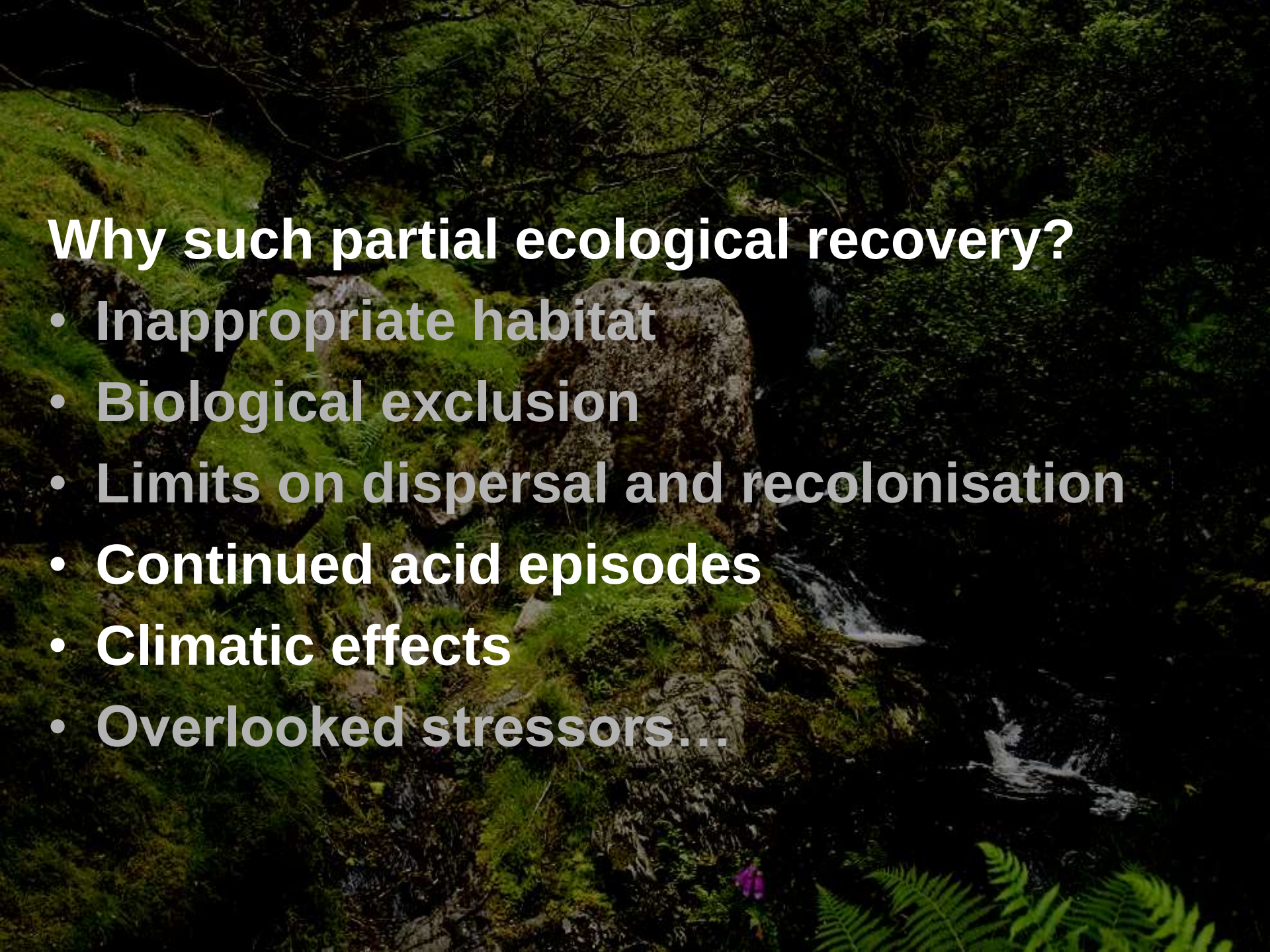
Invertebrate assemblage trends in streams at Llyn Brianne and across Wales, 1980s-present (DCA)

‘Acid’ → ‘Circumneutral’



Why such partial ecological recovery?

- **Inappropriate habitat**
- **Biological exclusion**
- **Limits on dispersal and recolonisation**
- **Continued acid episodes**
- **Climatic effects**
- **Overlooked stressors…**



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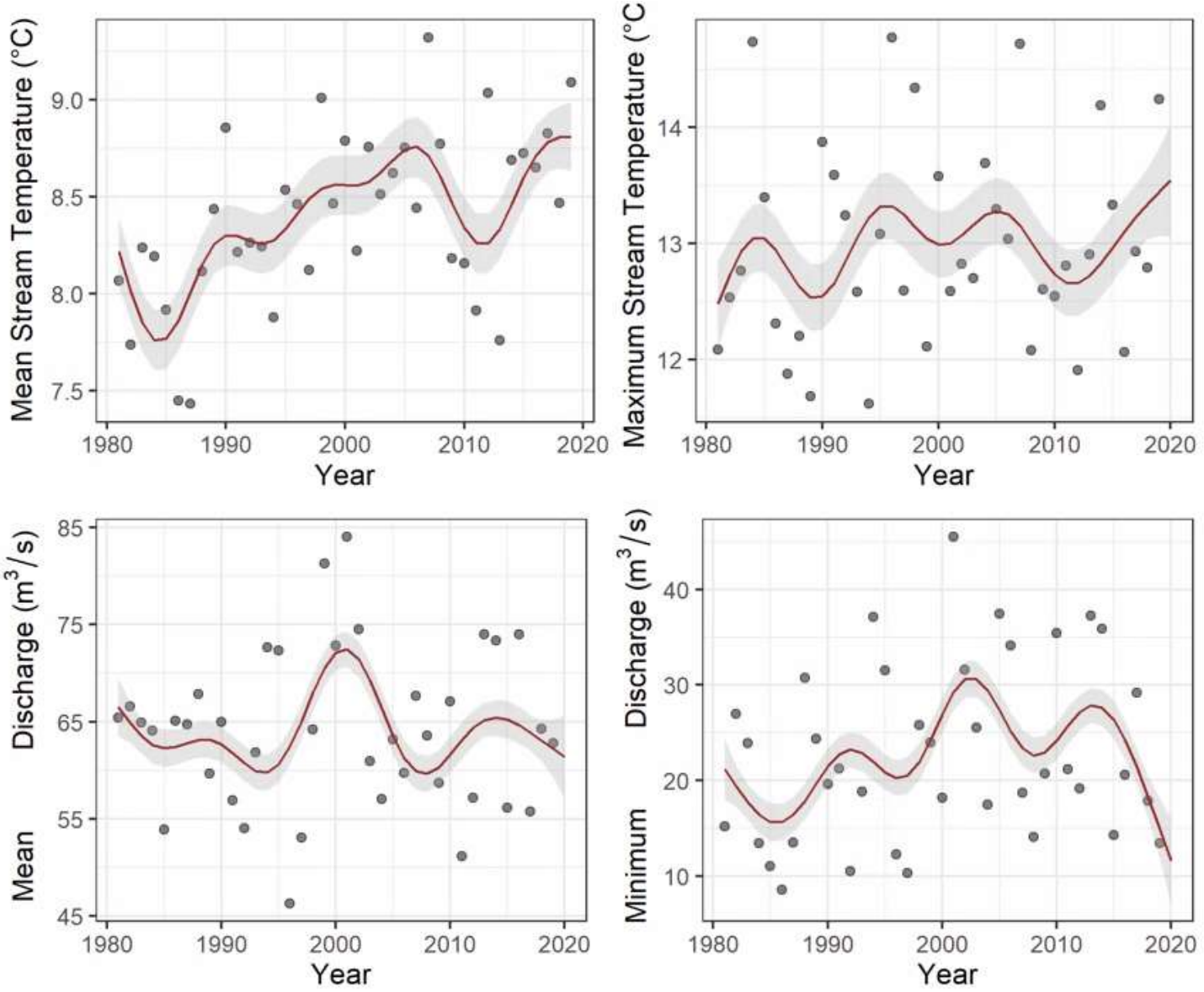
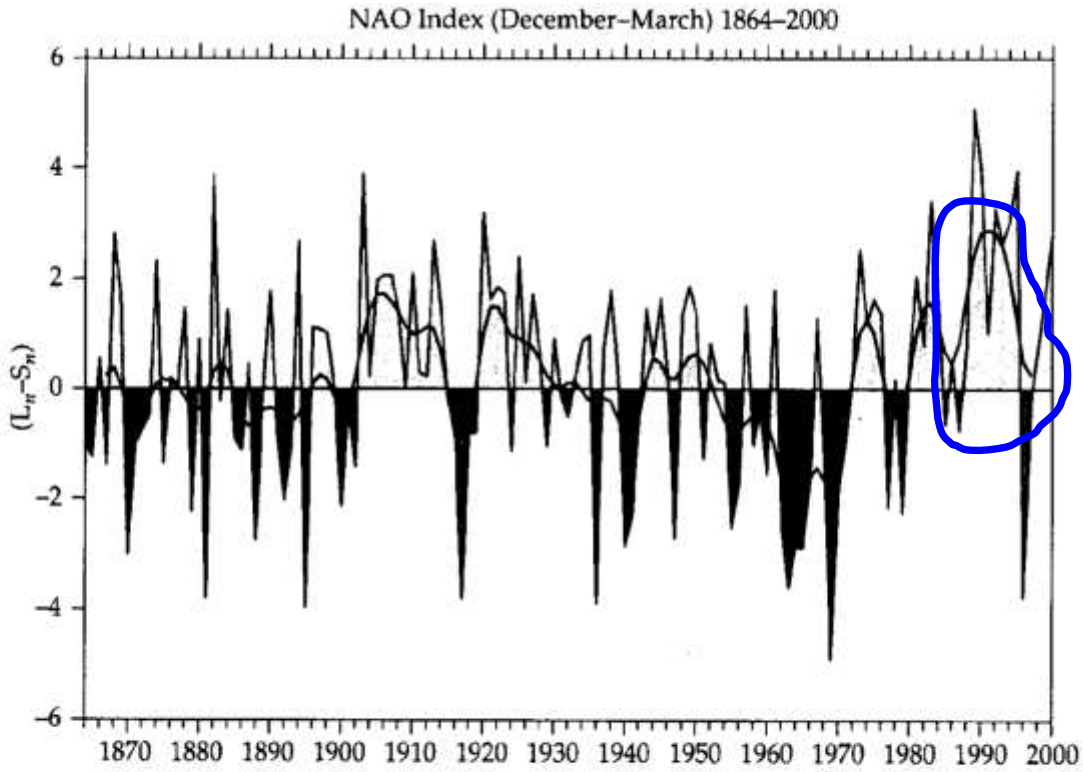


Stream temperature and discharge trends at Llyn Brianne over 40 years (Fiona Joyce)

Hurrell's NAO index.

Warm, wet, stormy

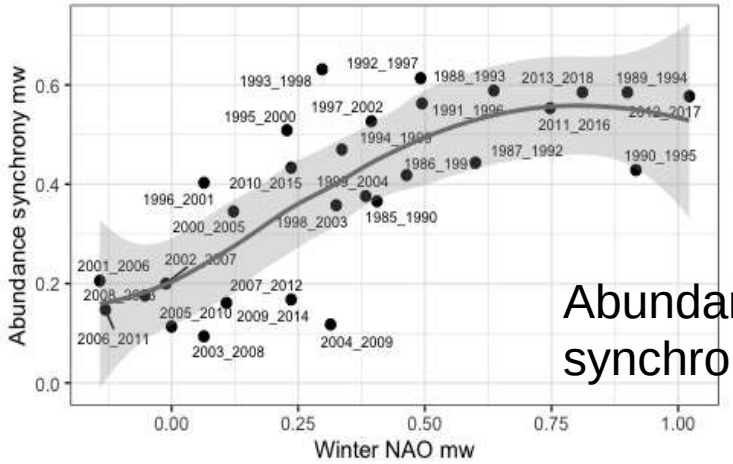


Cold, dry, calm

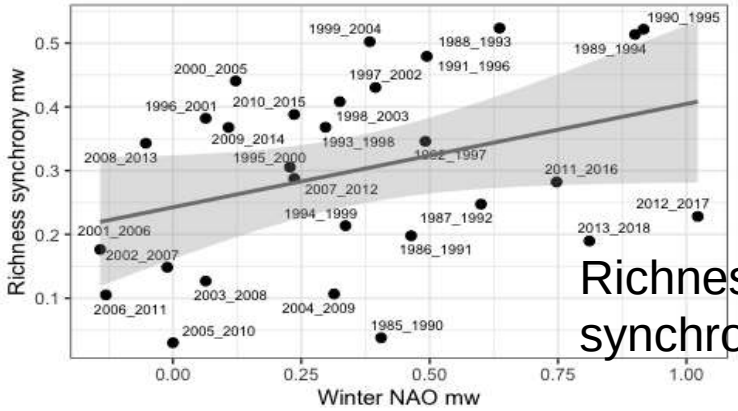
Positive amplification

Figure 2.2 Winter (December–March) index of the NAO based on the difference of normalized SLP between Lisbon, Portugal, and Stykkisholmur/Reykjavik, Iceland from 1864 through 2000. The indicated year corresponds to January (e.g. 1950 is December 1949–March 1950). The average winter SLP data at each station were normalized by division of each seasonal pressure by the long-term mean (1864–1983) standard deviation. The heavy solid line represents the index smoothed to remove fluctuations with periods less than 4 years.

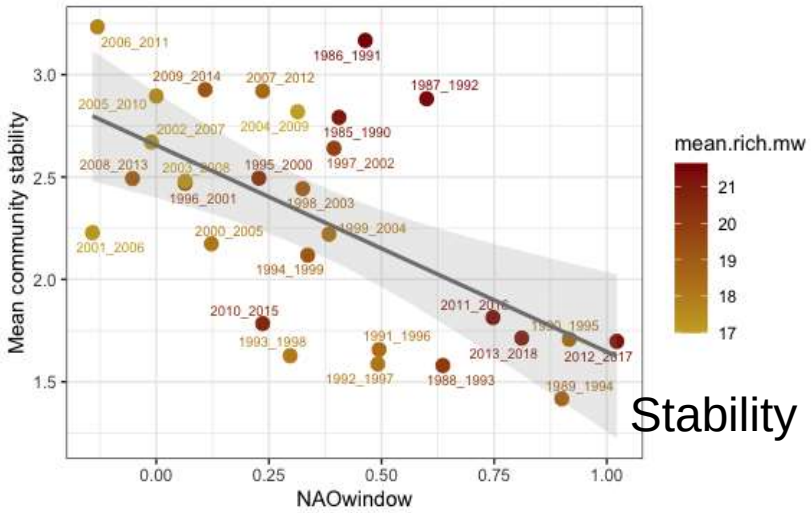
J. W. Hurrell et al. 2004



Abundance synchrony



Richness synchrony



Stability

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RESEARCH ARTICLE

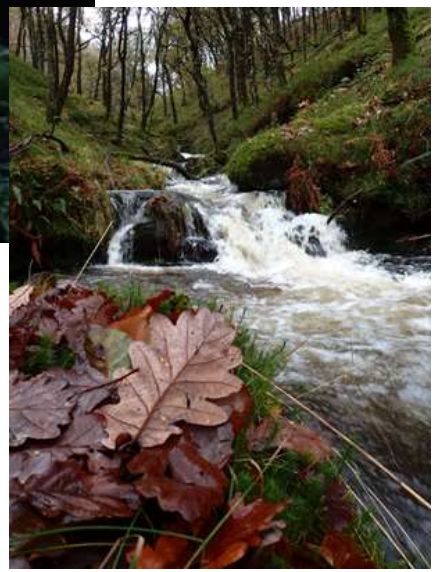
Global Change Biology WILEY

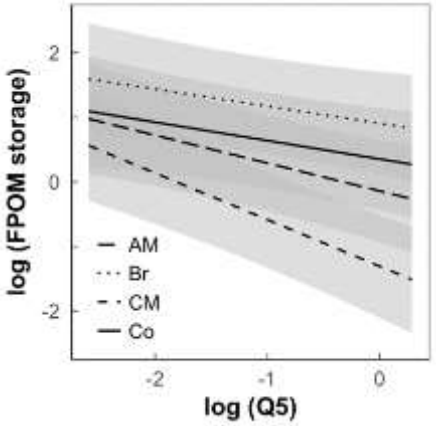
Climatic effects on the synchrony and stability of temperate headwater invertebrates over four decades

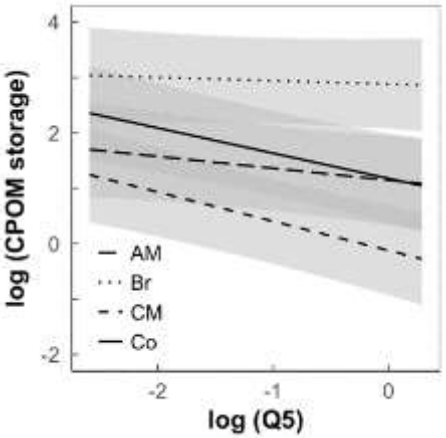
Stefano Larsen[1] | Fiona Joyce[2] | Ian P. Vaughan[2] | Isabelle Durance[2] | Jonathan A. Walter[3,4] | Steve J. Ormerod[2]

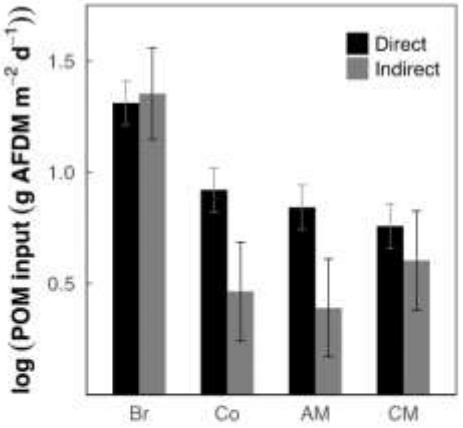
40-year data show how warm, wet winters synchronise insect abundance, richness and resilience

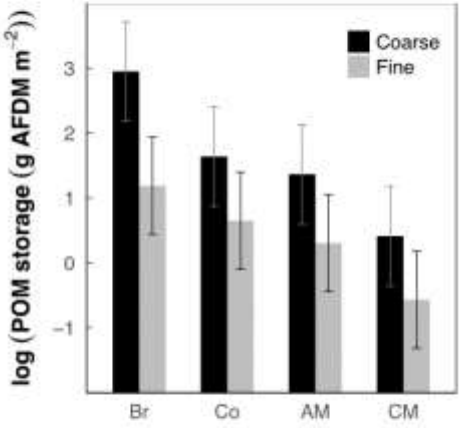
Stefano Larsen

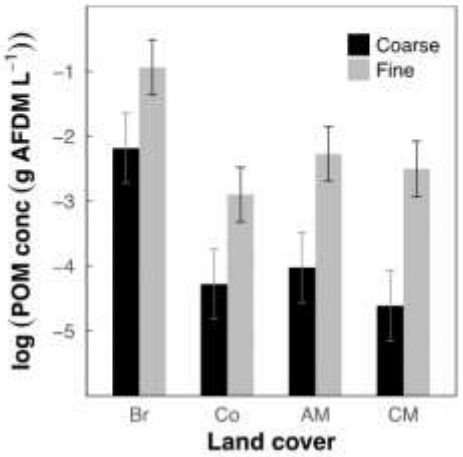








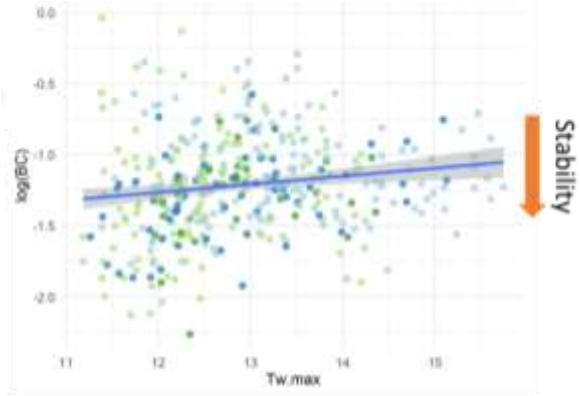




Leaf-litter is lovely!

Warming and floods deplete leaf-litter – but offset where deciduous compensate losses

(Marian Pye and others)



Native woodland increased resilience to climate change over 40 years

Fiona Joyce

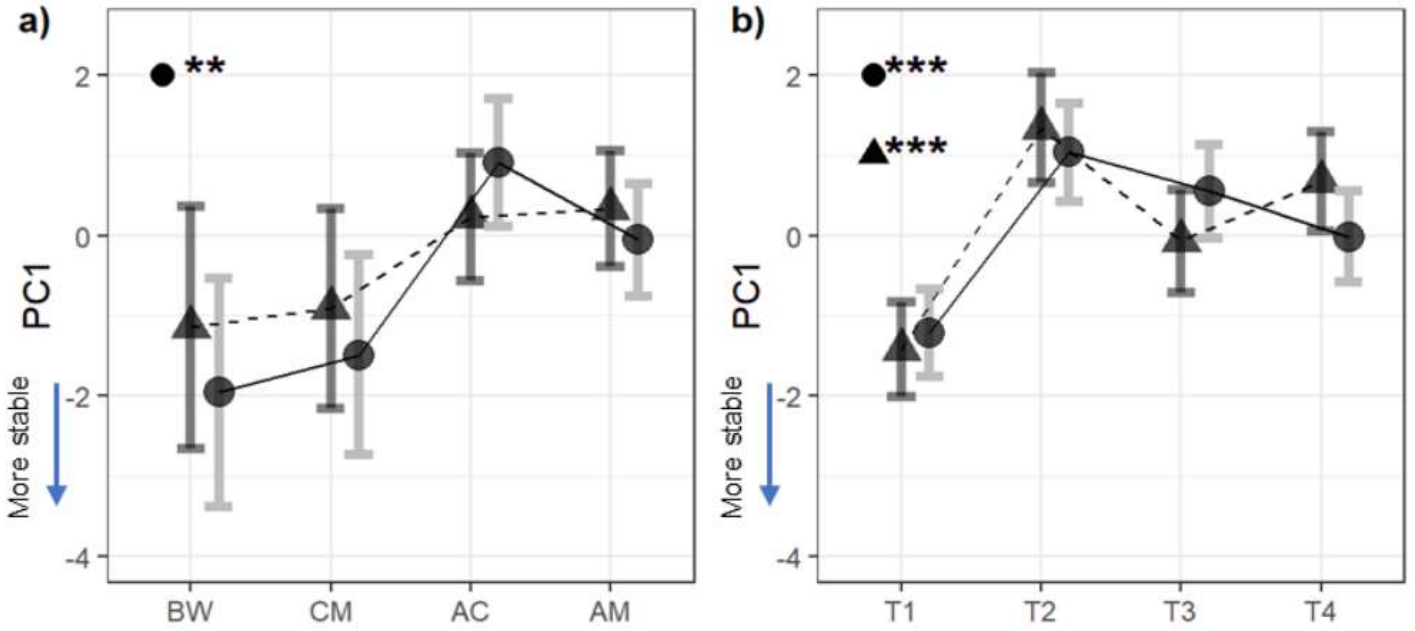


Figure 4.5 *Effects of stream type and decade on the first two components of taxonomic and functional stability. Plots show differences in taxonomic and functional PC1 between* ***a)*** *stream types, and* ***b)*** *decades, and differences in taxonomic and functional PC2 between* ***c)*** *stream types, and* ***d)*** *decades. Where overall statistical significance was found, this is shown for taxonomic and functional data, respectively. *p < 0.05, **p < 0.01, ***p < 0.001.*

Natural Environment Research Council

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defra
Department for Environment Food and Rural Affairs

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UCL

Imperial College London

Queen Mary University of London

Lancaster University

Over 40 years, Brianne's long-term data and experiments have:

- Helped to reveal acid rain effects on streams, influencing UK/EU pollution policy
- Influenced UK afforestation guidelines
- Revealed effects of climate change and fluctuations on stream ecosystems influencing climate adaptation strategies ('Keeping Rivers Cool')
- Led to large numbers of inter-disciplinary scientific outputs
- Aided the training of at least 40 PG students
- Laid the foundations for future long-term studies