

Nature-based Solutions for Catchment Water Challenges

Impact cases from the ‘Achieving multipurpose Nature-based Solutions’ project

Mark Wilkinson¹, Steve Addy¹, David Boldrin¹, Esther Carmen¹, Susan Cooksley¹, Jennifer Dodd², Josie Geris³, Cathy Hawes¹, Paul Quinn¹, Martyn Roberts¹, Marc Stutter¹, Helen Watson¹, Kerry Waylen¹

1.James Hutton Institute
2.Napier University, Edinburgh
3.University of Aberdeen



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Introduction

Nature-based Solutions (NbS) address many water-related environmental pressures, yet their adoption remains slow. They can also play a vital role in addressing the climate crisis. **This research examines the impacts of NbS on the water environment, identifies ways to maximise their benefits, and investigates how to scale delivery across sectors.** We showcase findings from multiple measure types, demonstrating how they can be optimised for water management, and emphasise the crucial role of people in making NbS a reality.

Getting the Right Measure in the Right Place: Key messages from example case studies

Leaky barriers for flood management

- Headwaters are key areas that generate flood runoff.
- Leaky barriers are a popular Natural Flood Management approach: but how effective are they?
- Elm Sike case study: More effective in low-gradient (<0.01 m/m) streams with floodplains that offer expandable storage.
- **Larger, well-spaced barriers (avoiding overlapping backwaters) are needed for stronger hydraulic effects.**
- Evaluating new measure designs at Glensaugh.



Leaky barriers for managing low flows

- For industries such as Scotch whisky production, low flows are an existential risk.
- Glenlivet: 40 pilot Leaky barriers (~2m³ each) Modelling: increased groundwater contributions to streamflow by ~4%, boosted Q95 flows by ~1%.
- Placement in freely-draining soils maximised benefits, and distributed networks of small features were more effective than fewer large ones.
- **Cost-benefit analysis showed that even small improvements in low flow, such as a 1% uplift in Q95, can translate into economic value.**



Field bunds for managing erosive convergent flow paths

- The risk of muddy flooding is ever increasing > larger flood events and more soil erosion (e.g., Storm Babet).
- Soil bunds are small-scale, soft-engineered features that temporarily hold back water in headwater catchments to slow runoff and reduce flood peaks.
- **Peak flow reductions of >10% typically require ~2,000–4,000 m³ of additional storage per km².**
- New tool optimises pond by evaluating bund height, storage, outlet & infiltration to guide site-specific runoff attenuation.



Magic Margins for managing diffuse flow paths

- Engineered ridges constructed across sloping fields using a potato drill plough and tied ridging machine.
- Cost-effective solution to reduce runoff from arable fields: But is this the most effective design?
- Balruddery Farm case study: Margin installed in March 2024 and vegetated with contrasting vegetation types.
- **Design Recommendations: Field-margin connection drives effectiveness. A diverse mix of plant species enhances ability to infiltrate water and stabilises ridges.**



River restoration for improving aquatic habitats

- River restoration projects are becoming widespread in Scotland, bringing benefits for climate, nature & wellbeing.
- The award-winning Easter Beltie restoration brings extensive wetlands and re-meandering to a canalised agricultural stream, combining multiple elements to maximise benefit.
- The site is a focus for research in full BACI design to establish new powerful and effective monitoring techniques.
- **Exploring potential indicator groups using metagenomic techniques, as standard methods are too coarse to evaluate change.**



The role of people in making this happen

- Multiple risks and benefits recognised by businesses and people from the natural environment.
- Some are interested in NbS and may be involved already but often contribute in different ways and for different reasons.
- Practical changes to activities, alongside emphasising added social value for interconnected business sectors, could improve involvement.
- **Need processes to bring together people and to develop partnerships around benefit clusters.**



Summary

- Since 2022, hundreds of visitors have experienced our case study sites: Place-based examples that turn abstract concepts into practical understanding.
- Robust evidence shared widely: e.g., media features, press releases, farmer guidance, and webinars connecting NbS to real flood and drought events.
- **No single measure is enough: Effective catchment management demands a treatment-train approach powered by a diverse NbS toolkit.**

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Glenlivet video



Beltie Burn video



Magic Margin video



Glensaugh NFM video



3D buffer approach



<https://tinyurl.com/AIMNBS>



Mark.Wilkinson@hutton.ac.uk



<https://www.nfm.scot>



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