



**THE SCOTTISH
REWILDING ALLIANCE**

Flooded marshland and farm track at Duthil in
the Cairngorms National Park, Scotland.
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Slow the flow: Working with nature to increase Scotland's flood resilience

As severe weather events increase in both frequency and intensity across Scotland, existing flood defences face unprecedented pressure. Traditional flood management in Scotland relies heavily on downstream hard engineering (e.g., flood walls, artificial embankments). While these structures protect targeted areas, they do not address the root causes of flooding. They can also fail under extreme weather, contribute to emissions and carry significant long-term maintenance costs.

Decades of upland drainage, native woodland clearance, and river channelisation have severely degraded the capacity of Scottish landscapes to absorb and slow heavy rainfall. The loss of natural coastal buffers like sand dunes, saltmarshes, and underwater reefs leaves our coastlines exposed, allowing high tides and storm surges to hit communities with full force. Our cities and towns have huge areas of hard surfaces and super-fast drainage systems that ensure water leaves these areas as quickly as possible rather than soaking into the land.

Nature-rich uplands slow water and provide enhanced water storage at a landscape scale. Rivers that are allowed to expand across their floodplain after heavy rain or snow, rather than being tightly contained in deep channels, act to slow the flow of water off the land. Sand dunes, replenished beaches, healthy coastal ecosystems and intertidal habitats mitigate against coastal flooding. In cities and towns, revitalising rivers, marshes and wetlands can work hand-in-hand with other systems like rain gardens.

A shift toward catchment-wide restoration is urgently required to build long-term resilience against climate disruption. In vulnerable communities where hard defences are vital, upstream catchment restoration acts as a first line of defence — slowing water before it reaches town centres, reducing peak loads on walls and embankments, and extending the operational lifespan of major civil infrastructure. Every patch of land in a catchment, including those in urban areas, can help slow the flow of water and reduce flood risk.

Introduction

Nearly 284,000 properties across Scotland are currently exposed to flood risk — and that is projected to reach almost 400,000 over the coming decades. [1]

Flooding disproportionately impacts socially and economically disadvantaged communities, leaving households facing long periods of displacement, repair costs, and acute mental health strains. Relying solely on localised, downstream defences leaves these communities exposed when extreme weather events exceed design thresholds. Recent scrutiny from Audit Scotland highlights that the current funding mechanism for major flood schemes is no longer fit for purpose, warning that inequalities will widen unless urgent action is taken at scale.

Scotland's National Flood Resilience Strategy highlights the importance of nature-based actions [2] and Scotland already has a central hub dedicated to sharing best practice [3] as well as many examples of how nature can aid us in holding back floodwater. Yet the focus, and funding, remains geared towards hard-defence engineering projects that cost more and provide fewer ecological and societal benefits. Catchment-wide natural flood management creates a crucial buffer that mitigates impact severity across entire river basins — ensuring resilience is extended to all downstream communities, regardless of whether they have formal hard-defence infrastructure.

Unlike concrete flood walls, nature-based solutions also deliver compounding socio-economic and environmental returns across multiple policy areas. Upstream restoration also enhances carbon sequestration within intact peatlands and growing woodlands, directly contributing to Scotland's net-zero targets.

Furthermore, nature-based approaches filter agricultural run-off, improve water quality, boost biodiversity, and create resilient habitats that support rural eco-tourism, providing a sustainable return on public investment.

Cost

Capital expenditure on major hard flood schemes in Scotland has tripled. Between 2015 and 2025, the total projected cost for approved local council flood protection schemes surged from £350 million to over £1 billion. [4]

Since 2016, 80% of funding has been allocated to large scale projects distributed according to the Scottish Government and COSLA funding framework, guided by SEPA's Flood Risk Management Strategies. [5] Those projects are overwhelmingly hard-defence infrastructure.

The remaining 20% of funding is distributed to councils via a formula based on population and risk, and must cover watercourse maintenance, flood warning infrastructure, surface water management and any NFM studies or projects. As a result, hard-defence engineering schemes swallow virtually the entirety of funding available for flood defence in Scotland.

Despite one of the objectives of flood resilience planning set by SEPA to “Consider whole catchments and coastlines, working with natural processes and the environment to deliver multiple benefits”, the vast majority of schemes focus on high-cost, hard engineering. In contrast, Natural Flood Management (NFM) techniques or working with natural processes — such as through upland peatland restoration, river re-meandering, and targeted native planting — offer a significantly lower cost-per-benefit ratio. By intercepting water at the source, upstream restoration reduces the volume and velocity of floodwaters reaching high-value downstream assets, extending the lifespan of existing urban infrastructure and lowering long-term public expenditure.

Case study: Eddleston Water

As the UK’s only UNESCO Ecohydrology Demonstration Site, the Eddleston Water Project in the Scottish Borders provides proof of catchment-scale Natural Flood Management (NFM) in action. The Tweed Forum has worked across the catchment to re-meander rivers, plant native trees, create flood storage ponds and install log structures. Monitoring led by Dundee University recorded a 29% reduction in high-flow event frequency in downstream Peebles (and up to 50% upstream), alongside a 3 to 7-hour delay in peak flood arrival times during storm events.

This catchment-wide restoration cost a fraction of traditional concrete schemes while delivering an estimated £17.7 million in total ecosystem value — raising the river’s ecological status from “Bad” to “Moderate,” boosting Atlantic salmon spawning habitats, and establishing a scalable template for climate resilience across Scotland.



Remeandered section of Eddleston Water surrounded by agricultural fields
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Restoring upland and wetland hydrology

The loss of native vegetation and peatland degradation in upper catchments accelerates surface runoff directly into river networks. Restoring native upland tree cover can increase soil infiltration rates up to 60 times faster than heavily grazed pasture [6], while targeted reforestation of just 5% of a catchment headwater can reduce peak downstream flows by nearly 30% [7]. Reduced soil compaction and deep root networks slow down the rapid flow of water over land. [8]

Blocking drainage ditches in peatlands and restoring natural wetlands transforms degraded landscapes into hydrological sponges that store excess water during intense rainfall and release it gradually during dry periods. [9] [10] By blocking drainage channels, beaver activity transforms degraded peatlands into sponges, increasing groundwater levels by up to 37 times to retain moisture and regulate catchment runoff. [11]

Case study: Ben Wyvis National Nature Reserve and River Peffery

At Ben Wyvis National Nature Reserve in the Highlands, large-scale peatland rewilding provides a clear example of upstream hydrological restoration directly mitigating downstream urban flood risk. To protect communities like Dingwall along the River Peffery catchment, partners restored nearly 340 hectares of degraded blanket bog by blocking miles of artificial drainage channels (grips) and reprofiling eroded peat hags across the high plateau.

Hydro-monitoring demonstrates that halting high-velocity runoff off Ben Wyvis transforms the upland into a natural retention sponge, flattening storm peak discharges and significantly delaying water arrival times downstream — allowing re-meandered downstream rivers to safely absorb remaining surge volumes before they reach built-up areas. [12]



Reconnecting and revitalising rivers

The condition of rivers has a major impact on the speed and severity of flooding. Straightened rivers with artificial banks can cause water to flow rapidly downstream, hitting villages, towns and cities harder.

Reconnecting rivers to their natural floodplains and installing leaky wood structures holds water in low-risk upstream zones, protecting downstream communities.

The restoration of rivers can be accelerated through keystone species like the Eurasian beaver. Beaver dams act as natural, low-cost flood barriers that slow water velocity, extend runoff travel times from hours to days, and filter sediment — all without requiring public capital for ongoing structural maintenance. Monitoring of beaver dams has shown that beaver dams can lessen flood flows by 30 to 50%. [13] The wetlands that beavers create also provide food, shelter and homes for all kinds of wildlife including dragonflies, butterflies, brown trout and bats.

Case study: Ealing Beaver Project

In urban areas, nature-based solutions such as beaver reintroductions can help mitigate flooding. In Ealing, the Ealing Beaver Project aimed to reduce flooding caused by high rainfall events overwhelming the storm water system. The area had been identified for expensive engineering works to tackle flooding, but beavers offered a cheaper, natural solution.

Beavers build dams and complex wetlands that hold more water. During high rainfall events, water flows are now slower compared to before the beavers' arrival, leading to less urban flooding downstream. [14]



Beaver release at Ealing / Photo from Ealing Wildlife Group

What we want to see

Scotland is a network of regions, landscapes and ecosystems; a mosaic of sectors and businesses; a web of different communities. Working across all of these will achieve the most efficiency, consistency and value. Creating flood resilient places requires transformational changes in land management.

Joined-up approaches to land management, such as the Regional Land Use Partnerships, should be empowered and resourced to cover flood resilience. Existing work to restore landscapes and coastlines at scale should be supported and expanded. Flood resilience should be incorporated into broader land use and urban planning processes and other policy frameworks.

Communities should be actively involved in planning and delivering flood actions, as their participation can enhance the design and acceptance of flood measures.

Recommendations

- Shift national funding frameworks toward catchment-scale management rather than isolated, local downstream engineering projects.
- Ensure that regional Flood Risk Management Strategies prioritise Nature-Based Solutions (NBS) alongside traditional hard infrastructure.
- Reshape land management and agricultural support schemes to incentivise landowners to maintain flood-mitigating features (e.g., native scrub, wide hedgerows, wetlands, leaky dams, beaver wetlands).
- Put flood-prone downstream communities at the core of catchment planning, enabling them to collaborate and negotiate directly with upstream landowners.

References

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Alongside thousands of people and organisations across Scotland, we urge the Scottish Government to declare Scotland a Rewilding Nation, with 30% of land and sea managed on rewilding principles. This can be done by restoring wild habitats such as peatlands, native woodlands, wetlands, rivers and seas, while maintaining and benefitting agricultural land used for growing food.



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