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CASE STUDY
01

Managing Runoff Pathways to Mitigate Diffuse Pollution with Nature-based Solutions

The Problem

Climate change and intensive land use management has increased the speed and volume of surface runoff. Generally, water can move quickly off fields (if poorly managed), tracks, and drained land, bypassing the landscapes natural buffering capacity for managing water quality and quantity. This rapid runoff carries sediment, nutrients, and agrochemicals into ditches and watercourses, while also contributing to downstream flood risk (O'Connell et al., 2007; Rogger et al., 2017).

The Role of Nature-Based Solutions (NbS)

Nature-based Solutions (NbS) are interventions that restore or mimic natural processes to manage water more effectively (Nesshöver et al., 2017; OECD, 2020). They can be placed along fast flow pathways that carry sediment- and nutrient-rich water, helping to disconnect and slow these flows (Quinn et al., 2022; Roberts et al., 2023). This increases the time water spends within soils, vegetation, and the wider catchment, reducing pollutant transport and delaying flood peaks (Hewett et al., 2020; Lane, 2017). In doing so, NbS restore the catchment's natural buffering capacity against the growing challenge of climate change-induced extreme storm events. They also deliver wider co-benefits, including improved biodiversity, habitat restoration, and groundwater recharge (Keesstra et al., 2018; Penning et al., 2023).

Key Processes

NbS measures typically work by one or a combination of the following:

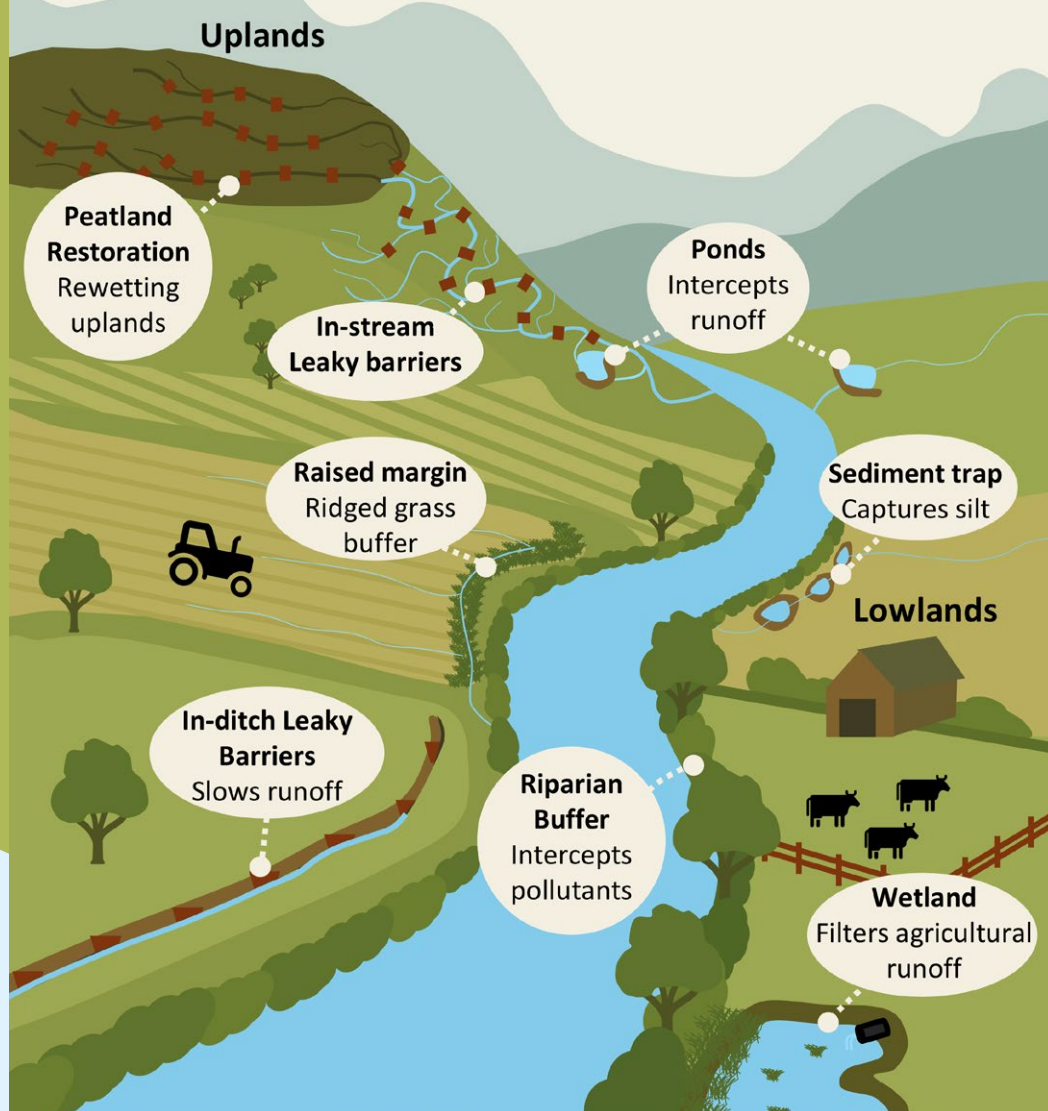
- > **Slowing flows** – increasing surface roughness, reducing flow velocity, and backing up water, thereby disrupting fast runoff pathways.
- > **Temporary storage** – implementing natural barriers in the landscape and drainage network creates new and dispersed storage on land during storm events, attenuating runoff pathways and delaying peak flows.
- > **Sediment deposition** - encouraging soil particles to settle in designated areas where sediment can be managed, rather than lost downstream. Land manager can recapture lost soil.
- > **Filtration and uptake** – vegetation and soils filter pollutants, absorb nutrients, and enhance water quality.

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Nature-based Solutions in Action

The right measures in the right places



Selecting the Right Measure

Individual measures share many of these functions, but differ in their design, scale, and land requirements. Their effectiveness depends on careful siting: the right measure in the right place (Figure 1). For example, some are best suited to intercept diffuse runoff on slopes, while others target concentrated flow in ditches or channels. Often, the greatest benefit is achieved when measures are combined in sequence across a catchment.

Figure 1: Schematic examples of nature-based solutions (NbS), illustrating how different measures can be targeted to the right places in the landscape

Next Steps

The following overview sheets describe a range of NbS measures, their primary functions, and considerations for design, siting, and maintenance. This information is intended to support the assessment of NbS proposals, ensuring that the right measures are deployed in the right places to address water quality challenges

Further Information

- Lane (2017). Natural flood management. Wiley Interdisciplinary Reviews: Water, 4(3), e1211. <https://doi.org/10.1002/wat2.1211>
- O'Connell et al. (2007). Is there a link between agricultural land-use management and flooding? Hydrology and Earth System Sciences, 11(1), 96–107. <https://doi.org/10.5194/hess-11-96-2007>
- OECD. (2020). Nature-based solutions for adapting to water-related climate risks. In OECD Environment Policy Papers (Issue 21). <https://doi.org/10.1787/2257873d-en>
- Penning et al. (2023). Nature-based solutions for floods AND droughts AND biodiversity: Do we have sufficient proof of their functioning? Cambridge Prisms: Water, 1, e11. <https://doi.org/10.1017/wat.2023.12>
- Roberts et al. (2023). Mitigating floods and attenuating surface runoff with temporary storage areas in headwaters. WIREs Water, 10(3), e1634. <https://doi.org/10.1002/wat2.1634>

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