



# Policy brief

## Freshwater Restoration under the Nature Restoration Regulation

A Roadmap Approach for National Implementation

### Key NRR Articles

- 4: Terrestrial, Coastal and Freshwater Ecosystems
- 9: River Connectivity
- 14: Preparation of NRPs
- 15: Content of NRPs
- 20: Monitoring
- 21: Reporting

### Key Messages

- Choosing the right restoration locations is critical for ecological recovery; **catchment-scale assessments can help identify priority sites and measures and maximise restoration benefits**, see [recommendation 1](#).
- Biodiversity recovery alone does not capture restoration success; **implementing authorities could incorporate biodiversity and ecosystem functioning indicators into National Restoration Plan (NRP) monitoring frameworks**, see [recommendation 2](#).
- Addressing a single pressure may limit ecological recovery; **national authorities can use integrated approaches that tackle multiple drivers of freshwater degradation**, see [recommendation 3](#).
- Long-term freshwater restoration can benefit from local knowledge and sustained engagement. **National authorities can strengthen by supporting participatory monitoring and knowledge exchange**, see [recommendation 4](#).
- Habitat fragmentation limits freshwater recovery; **national authorities can incorporate ecological connectivity into restoration planning**, see [recommendation 5](#).
- Effective restoration requires reliable evidence; **shared guidance, harmonised monitoring, and common data standards can support NRP implementation and adaptive management**, see [recommendation 6](#).



### Introduction: How can this brief help you?

The **EU Nature Restoration Regulation (NRR)** establishes obligations for the restoration of freshwater ecosystems through targets for terrestrial, coastal and freshwater ecosystems (**Article 4**), measures to restore river connectivity and natural floodplain functions (**Article 9**) and monitoring and reporting obligations (**Articles 20 and 21**). Through **National Restoration Plans (NRPs)**, Member States will plan, implement and monitor these restoration measures. Freshwater restoration requires prioritising actions at the catchment scale, addressing multiple drivers of degradation, restoring ecological connectivity, and establishing robust approaches for monitoring and adaptive management.

This brief provides recommendations for national authorities, river basin managers, and restoration

practitioners to support NRP preparation and implementation. It forms part of a series of four implementation briefs covering forest, freshwater, marine and coastal, and urban ecosystems. Readers may also find the forest ecosystem brief particularly relevant. The recommendations are organised as a phased roadmap covering: i) NRP preparation, publication, and early implementation; ii) implementation of restoration objectives towards 2030; and iii) longer-term monitoring, reporting, and adaptive implementation beyond 2030.

Drawing on evidence from the BiodivRestore-funded projects **COSAR**, **FreshRestore**, **ForestFisher** and **RESTOLINK**, this brief highlights practical implementation approaches to strengthen freshwater restoration planning, delivery and long-term ecological recovery.



## Recommendations: A Roadmap Approach for NRP Preparation and Implementation

As illustrated in **Figure 1**, the recommendations are structured as a phased roadmap approach to support NRP preparation, implementation, and the delivery of restoration targets over time. The following recommendations are organised according to these implementation phases.



Figure 1 - Recommendations for the NRP Preparation, Review and Early Implementation phase

### NRP Preparation, Review and Early Implementation (0-2 years / 2026 – 2028)

#### Recommendation 1: Identify and Prioritise Freshwater Restoration Opportunities using Catchment-Scale Ecological Assessment

**NRR Articles 4** and **9** require Member States to identify and implement restoration measures for freshwater ecosystems, including measures to improve river connectivity and restore natural floodplain functions.

Authorities are encouraged to use catchment-scale assessments that integrate ecological condition, connectivity, pressure mapping, and expected restoration benefits to identify priority restoration areas and select measures within NRPs.

##### Case Study 1: Using Catchment Context to Improve Restoration Prioritisation

The COSAR project analysed 226 river restoration projects across Europe to understand why some restoration measures deliver stronger ecological outcomes than others. The analysis found that restoration success is strongly influenced by catchment conditions, surrounding land use, and the scale of intervention. Local site characteristics alone may not fully explain ecological recovery outcomes, the wider catchment must be taken into consideration.

#### Recommendation 2: Establish a Restoration Monitoring Protocol that considers Biodiversity and Ecosystem Functioning Indicators

**NRR Articles 20** and **21** require Member States to monitor restoration progress and report on implementation outcomes.

National authorities could adopt monitoring frameworks that assess both ecosystem structure (e.g., biodiversity and habitat condition) and ecosystem functioning (e.g., nutrient cycling, food-web interactions, and hydromorphological processes). This can improve understanding of restoration effectiveness, support adaptive management, and strengthen long-term assessment of freshwater restoration outcomes.

##### Case Study 2: Developing Harmonised Frameworks for Freshwater Restoration Assessment

RESTOLINK developed and tested a harmonised monitoring framework to assess how river restoration affects biodiversity and ecosystem functioning across diverse environmental conditions and restoration contexts. The results showed that these two ecosystem attributes provide complementary information on restoration outcomes and reveal distinct dimensions of ecological recovery.



Image: a Brown Bear Hunting for Fish



Figure 2 - Recommendations for the Delivery and Assessment of First Major Restoration Targets phase

## Delivery and Assessment of First Major Restoration Targets (2-6 years / 2028 – 2032)

### Recommendation 3: Design Restoration Measures to Address Multiple Interacting Pressures

**NRR Articles 4 and 9** require Member States to implement measures that improve the condition, connectivity, and functioning of freshwater ecosystems.

National authorities could prioritise integrated restoration programmes that tackle multiple pressures simultaneously, particularly where ecological recovery is constrained by several interacting drivers of degradation.

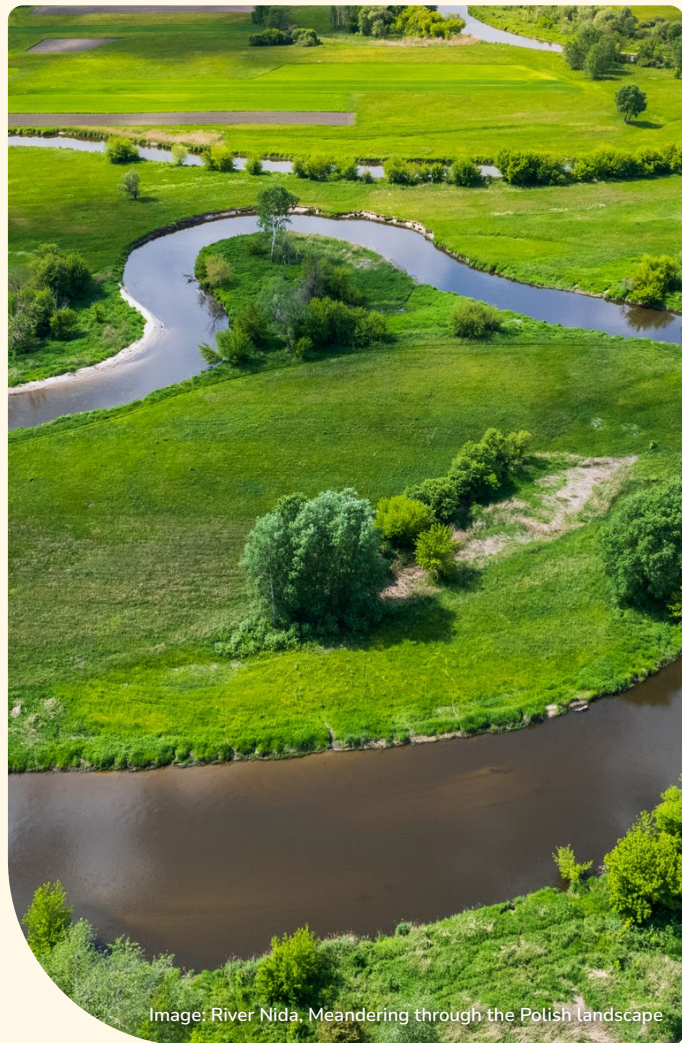
#### Case Study 3: Understanding Multiple Pressures in Freshwater Ecosystems

FreshRestore investigated how multiple environmental pressures influence freshwater biodiversity and ecosystem functioning across European lake systems. Combining ecological modelling, field observations, stable-isotope analysis, and large-scale datasets, the project examined how nutrient enrichment, habitat alteration, invasive species, and land-use change affect freshwater food webs and ecological processes. By tracing interactions across different trophic levels and environmental conditions, the project generated new insights into how multiple pressures interact and propagate through freshwater food webs and ecosystem

### Recommendation 4: Embed Participatory Monitoring and Knowledge Exchange in Freshwater Restoration Programmes

**NRR Article 4** requires Member States to plan and implement restoration measures for freshwater ecosystems, while **NRR Articles 14 and 15** require stakeholder participation and the description of stakeholder involvement in NRPs.

Across the research projects reviewed in this brief, participatory approaches were used to connect scientific evidence with management needs, stakeholder knowledge, and restoration practice. **Member States could encourage participatory monitoring, stakeholder involvement, and structured knowledge exchange within restoration programmes to complement formal monitoring efforts, strengthen communication between researchers and practitioners, and support adaptive freshwater restoration over time.**



#### Case Study 4: Supporting Participatory Freshwater Monitoring

To strengthen freshwater monitoring and stakeholder engagement, ForestFisher worked with and enhanced **ICTIQ**, a citizen-science platform that enables users to record fish observations and contribute ecological information to broader monitoring efforts. The tool was developed to support data collection, knowledge exchange, and public participation in freshwater management. Through this approach, the project demonstrated how local observations can complement scientific monitoring while strengthening community engagement within freshwater ecosystems.



Figure 3 - Recommendations for the Review and Revision Cycle, Scaling and Preparing for 2040/2050 Targets phase

## Review and Revision Cycle, Scaling and Preparing for 2040/2050 Targets (6+ years / 2032 Onwards)

### Recommendation 5: Improve Freshwater Connectivity through Network Scale Restoration Planning

**NRR Articles 4 and 9** require Member States to implement restoration measures that improve the condition, connectivity, and functioning of freshwater ecosystems.

After addressing isolated river catchment barriers, **National authorities can incorporate network-scale connectivity assessments into restoration planning and prioritisation processes to support more coherent and resilient freshwater restoration outcomes over time.**

#### Case Study 5: Identifying Connectivity Priorities Across Freshwater Networks

Restoring connectivity involves more than removing barriers or restoring isolated river reaches, as ecological benefits depend on species movement and habitat connections across freshwater systems. ForestFisher used species distribution modelling and future climate and land-use scenarios to examine how riparian forest loss, climate change, and habitat fragmentation affect freshwater habitat suitability and species movement, highlighting the value of planning restoration at broader

### Recommendation 6: Develop Shared Technical Guidance and Data Standards for Freshwater Restoration

**NRR Articles 15, 20 and 21** require Member States to plan, monitor, and report on restoration implementation and outcomes.

Differences in monitoring methods, assessment approaches, and data availability can make it difficult to compare restoration outcomes across projects and catchments. **Member States can establish shared technical guidance, standardised monitoring protocols, and interoperable data systems. This can improve the consistency of restoration implementation, support adaptive management, and strengthen long-term reporting under the NRR.**

#### Case Study 6: Developing Common Frameworks for Freshwater Restoration Assessment

Assessing restoration success can be challenging when projects use different indicators, monitoring approaches, and definitions of ecological recovery. RESTOLINK developed harmonised data collection protocols and assessment frameworks that enable restoration outcomes to be evaluated consistently across different climatic, biogeographical, and restoration contexts.

#### Link to sources

[COSAR](#) [FreshRestore](#)  
[ForestFisher](#) [RESTOLINK](#)

Scientific publications used in this policy brief can be found in the Information Sheet of this briefing downloadable from: [www.biodiversa.eu/policy-briefs](http://www.biodiversa.eu/policy-briefs)

#### Photos:

pg 1 (header) - Oeschinen Mountain Lake in Kandersteg, Switzerland 2024, by Daniil Korbut via [Unsplash](#)  
 pg 2 - Brown bear, Location Unknown 2023, by Lori Stevens via [Unsplash](#)  
 pg 3 - River Nida, Poland 2022, by merc67 via [iStock](#)

#### Contact

[contact@biodiversa.eu](mailto:contact@biodiversa.eu) | [www.biodiversa.eu](http://www.biodiversa.eu)

@biodiversa.eu

@biodiversaplus

#### About this Policy Brief

This Policy Brief is part of a series aiming to inform policymakers involved in the implementation of the Nature Restoration Regulation with policy recommendations based on the results of the BiodivRestore funded projects.

The series of Biodiversa+ Policy briefs can be found at [www.biodiversa.eu/policy-briefs/](http://www.biodiversa.eu/policy-briefs/).

This publication was commissioned and supervised by BiodivRestore and produced by Eli Morrell (Nature^Squared) and Iris Visser (Nature^Squared) with support of Cloé Durieux and Julie de Bouville, designed by Kelly Hartholt.

The key research results presented were co-drafted and validated by coordinators from the BiodivRestore funded projects COSAR, FreshRestore, ForestFisher and RESTOLINK.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them. This deliverable may not have been approved yet by the EC and may be subject to change.



Co-funded by the European Union under Grant Agreement 642426



MIX Paper from responsible sources FSC® C019064 Produced in June 2026