



# Policy brief

## Integrating the Biodiversity–Climate–Water Nexus into Forest Landscape Restoration

A Roadmap Approach for National Implementation

### Key NRR Articles

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

### Key Messages

- Standard monitoring may overlook early degradation from forest loss and climate change; **National Restoration Plans (NRPs) could use forward-looking forest–freshwater assessments to identify vulnerable ecosystems before decline becomes visible**, see [recommendation 1](#).
- Forest owners and managers respond differently to restoration policies. **Targeted incentives and support can help improve implementation across different owner typologies**, see [recommendation 2](#).
- River connectivity restoration may be less effective if forest loss and climate warming persist; **NRPs could combine it with catchment-scale riparian forest management**, see [recommendation 3](#).
- Climate change and fragmentation may reduce reintroduction success; **national authorities could integrate climate-risk and connectivity screening into restoration planning**, see [recommendation 4](#).
- Recovery of translocated populations may be gradual and non-linear; **NRPs could use standardised recovery stages and trend-based monitoring**, see [recommendation 5](#).
- Poor coordination across sectors and authorities can hinder restoration; **Member States could strengthen cross-sectoral coordination for planning and delivery**, see [recommendation 6](#).



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

The **EU Nature Restoration Regulation (NRR)** requires Member States to implement measures supporting the recovery of forest, terrestrial and freshwater ecosystems, including improvements in forest biodiversity indicators, ecological connectivity and river restoration under **Articles 4** (Terrestrial, Coastal and Freshwater Ecosystems), **9** (River Connectivity), and **12** (Forest Ecosystems). Forest ecosystems are major reservoirs of terrestrial biodiversity and play a critical role in maintaining freshwater ecosystems through water quality, hydrological processes, riparian habitat condition and ecological connectivity. Across Europe, many forest and forest-dependent freshwater ecosystems are facing increasing pressures linked to intensive management, habitat fragmentation and climate change.

This brief provides recommendations for national authorities, forest managers, landowners, 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 freshwater 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 research projects [BIOCONSENT](#), [ForestFisher](#), and [Transloc](#), this guide highlights practical implementation approaches related to restoration prioritisation, forest owner engagement, river connectivity, climate-risk screening, long-term monitoring, and cross-sectoral restoration planning.



## 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: Use Forest-Freshwater Assessments to Support Restoration Prioritisation

**NRR Articles 4, 9, and 12** establish restoration objectives for forest and freshwater ecosystems, while **Articles 14 and 15** require Member States to identify and map restoration needs within their NRPs.

National authorities could incorporate forward-looking assessments combining forest cover, freshwater connectivity, and climate projections when prioritising restoration areas and connectivity measures.

#### Recommendation 2: Use Targeted Incentives for Different Forest Owner/Manager Typologies

**NRR Articles 4 and 12** establish restoration objectives for terrestrial and forest ecosystems, while **Article 14** sets requirements for NRPs and implementation planning.

National authorities could incorporate tiered incentive frameworks into NRPs by combining financial incentives, technical support, regulatory approaches, reputational incentives, and advisory measures adapted to different owner groups.

#### Case Study 1: Forest Loss and Delayed Freshwater Responses

ForestFisher combined fish community data, land-cover mapping, and Species Distribution Models (SDMs) to assess how deforestation and climate change affect frugivorous fish across the Amazon Basin. The project identified delayed detectable responses to forest loss, with impacts on fish abundance becoming measurable around 5–7 years after canopy clearing. Using historical canopy-loss data and future climate pathways to 2090, ForestFisher applied SDMs to identify freshwater habitats that may become vulnerable before degradation is visible through conventional monitoring.

#### Case Study 2: Developing Incentive Frameworks for Different Forest Owner Groups

BIOCONSENT surveyed approximately 1,500 forest owners and managers across six European countries and identified four owner typologies: Multifunctionalists, Environmentalists, Optimisers, and Traditionalists. Multifunctionalists and Environmentalists were generally more supportive of restoration measures, while Optimisers and Traditionalists showed greater resistance. The project also identified behavioural inertia as a key implementation constraint and found that different owner groups may respond to different policy instruments, including financial compensation, technical support, and advisory measures. Further detail on these typologies is provided in the [Decision Making Support Toolbox](#).

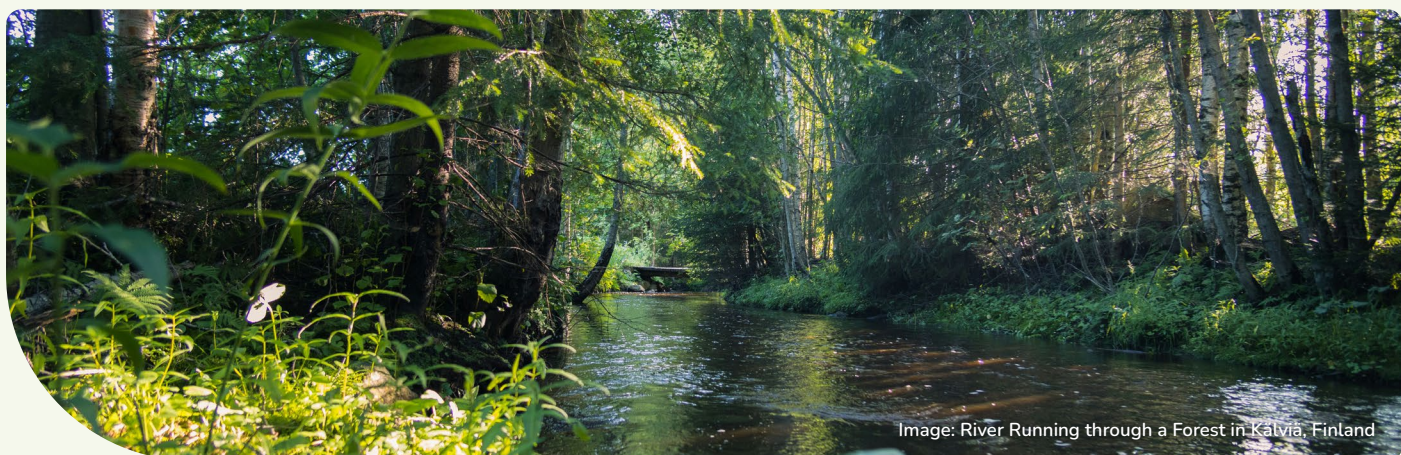


Image: River Running through a Forest in Kalvia, Finland



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: Establish Catchment-Scale Approaches for Riparian Restoration

**NRR Article 9** requires Member States to restore the natural connectivity of rivers and contribute to the restoration of free-flowing rivers.

National authorities could integrate barrier removal and connectivity restoration with catchment-scale riparian forest management and restoration measures.

#### Case Study 3: Riparian Buffers, Connectivity, and Climate Resilience

ForestFisher assessed how riparian vegetation and climate conditions influence freshwater connectivity for frugivorous fish species. The project found that restoring physical connectivity alone may be insufficient where riparian canopy loss increases water temperatures and reduces habitat quality under climate change. Connectivity analyses combined climate scenarios, projected infrastructure impacts, and habitat modelling for 52 species through to 2100. ForestFisher also used the TargetEconP model to examine riparian buffer strategies and land-use trade-offs, highlighting how riparian vegetation management can support connectivity and

### Recommendation 4: Introduce Climate-Risk Screening for Species Reintroductions

**NRR Articles 4** and **12** establish restoration objectives for ecosystems and biodiversity indicators, while **Article 14** requires Member States to prepare NRPs describing restoration measures and implementation arrangements.

National authorities could use climate-risk and connectivity screening approaches to evaluate whether release sites are likely to remain suitable under future climate and land-use conditions.

#### Case Study 4: Climate Change and Long-Term Translocation Viability

Transloc assessed how climate change and landscape fragmentation may affect the long-term viability of species translocations across Europe. The project developed the RELEASE (Reintroduction and Landscape Evaluation for Species Establishment) model, using analyses of 57 mammal species and candidate release sites to assess dispersal potential, ecological corridors, and roadkill risk under future scenarios. Transloc also screened 317 translocated mammal populations and found that many may face increasing climate risk by 2070, highlighting the importance of considering long-term habitat suitability and connectivity when selecting release



### Recommendation 5: Adopt Standardised ‘Recovery Stages’ for Long-Term Monitoring

**NRR Articles 20** and **21** require Member States to monitor and report on progress and trends every six years.

National authorities could integrate staged demographic monitoring and recovery-stage indicators into restoration reporting. The [Transloc Database](#) is a useful tool that supports standardised translocation reporting across projects and monitoring periods.

#### Case Study 5: Tracking Recovery Trajectories After Species Translocation

Transloc developed a standardised framework for assessing translocation outcomes across species with different life histories and monitoring periods. The framework classifies populations into five demographic stages - failed, failing, establishing, growing, and regulating - and summarises recovery trajectories using a demographic “progress score”. Using long-term monitoring data from species including *Arenaria grandiflora* and *Gyps fulvus*, the project showed that recovery may be gradual and non-linear, requiring monitoring approaches that can identify stalled or underperforming populations.



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 6: Strengthen Cross-Sectoral Coordination for Restoration Implementation

**NRR Article 14** requires Member States to consider coherence between NRPs, sectoral policies, and existing Union legislation.

Member States could therefore strengthen cross-sectoral coordination mechanisms within and across existing competent authorities to improve alignment between restoration, land-use, freshwater, and climate-related policies.



Image: Water Stream through Polish Forest Landscape

#### Case Study 6: Cross-Sectoral Coordination and Policy Coherence

BIOCONSENT analysed policy coherence and actor coordination across forest, biodiversity, climate, water, and bioeconomy policy areas in multiple European case studies. The project identified conflicts between forestry, renewable energy, biodiversity, and land-use policies that can create competing pressures on restoration. Its findings highlighted how misalignment between sectoral policies, governance responsibilities, and land-use priorities can affect restoration implementation.

#### Link to sources

[BIOCONSENT](#)  
[ForestFisher](#)  
[Transloc](#)

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) - Shkafane Forest in Durrës, Albania 2024, by SG via [Unsplash](#)
- pg 2 - River Vähäjoki, Finland 2024, by Juho Luhomala via [Unsplash](#)
- pg 3 - Long-eared Owl, Lingfield, UK 2021, by James Armes via [Unsplash](#)
- pg 4 - Water stream in forest, Poland 2024, by Camera Obscura via [Unsplash](#)

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#### 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/).

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