



# MERLIN



## Strengthening Freshwater Biodiversity Protection and Restoration under Natura 2000

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### Key messages

- ➔ **Freshwater biodiversity is declining despite existing EU legislation.** Current implementation of the Habitats Directive and the Water Framework Directive is not sufficient to halt degradation. Structural gaps in the Natura 2000 network must be addressed.
- ➔ **Natura 2000 does not adequately cover freshwater habitats in Europe.** Evidence shows that the coverage of freshwater habitats is low compared to terrestrial and coastal habitats. This limits the network's ecological effectiveness and resilience.
- ➔ **A targeted expansion of freshwater designations in Natura 2000 is needed.** EU Member States should assess whether additional sites are required and expand existing ones where necessary to ensure adequate coverage and ecological coherence.
- ➔ **Representation gaps weaken EU-level biodiversity outcomes.** Not all freshwater habitats – including those identified in the European Red List of Habitats – are covered across their natural range. This must be corrected.
- ➔ **Action is critical for delivering the Nature Restoration Regulation and the European Green Deal.** Without improved spatial coverage, restoration targets, water security and climate adaptation objectives will be harder and more costly to achieve.
- ➔ **The Commission should act now.** A coordinated EU-level review coupled with clear guidance and support for Member States is required to strengthen freshwater protection and restoration in Europe.



## Purpose and policy context

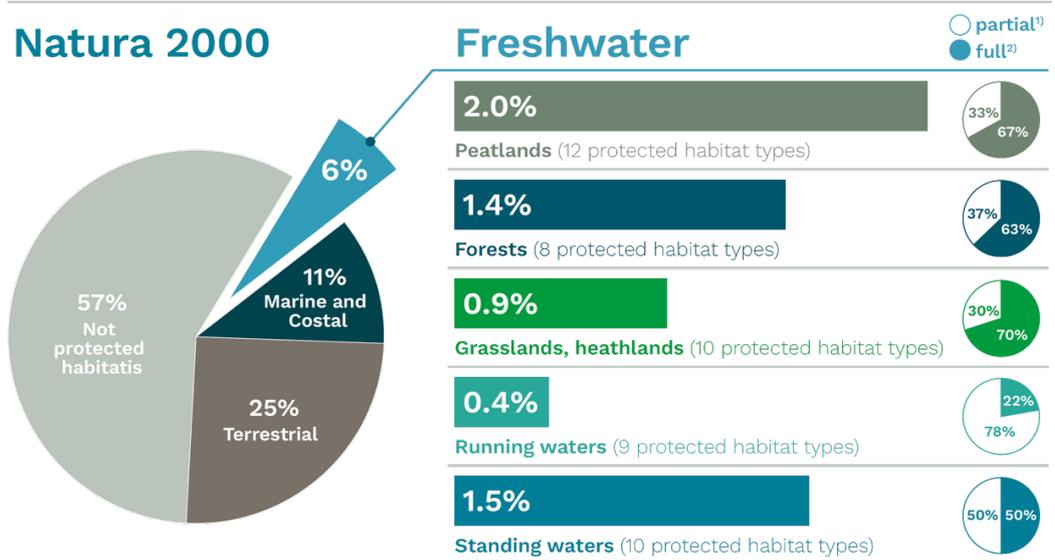
Freshwater ecosystems across the European Union remain under significant pressure from habitat alteration, pollution, water abstraction and climate change. Despite long-standing legal protections, their biodiversity continues to decline. This undermines the objectives of the EU Biodiversity Strategy, the European Green Deal and core legislation, including the Habitats Directive, the Water Framework Directive, and the Nature Restoration Regulation.

The Natura 2000 network is the EU's primary instrument for biodiversity conservation. However, its effectiveness for freshwater ecosystems remains limited. Evidence from the EU MERLIN project (project-merlin.eu) indicates that freshwater habitats are insufficiently covered, unevenly distributed and often fragmented within the network. These structural limitations constrain both protection and restoration outcomes.

A coordinated EU-level effort is therefore required to strengthen freshwater planning within the Natura 2000 network. EU Member States should assess whether the current designation of freshwater habitats is sufficient and take steps to strengthen coverage, coherence and restoration potential.

## Strengthening spatial coverage of freshwater habitats

A priority for improving freshwater conservation under Natura 2000 is to ensure that the spatial extent of designated freshwater habitats is sufficient to support ecological functioning, species persistence and long-term resilience. Current evidence indicates that freshwater habitats are underrepresented in the network, both in total area, and in relation to their actual distribution across Europe. This is particularly evident for running waters, which comprise only 0.4% of the Natura 2000 network, despite hosting 71% of Europe's threatened freshwater species. While rivers and streams are linear systems, their limited inclusion in Natura 2000 cannot be explained by this characteristic alone.



1) partial: % of Annex I habitat types not represented across all biogeographical regions where the habitats are Red Listed  
2) full: % of Annex I habitat types represented across all biogeographical regions where the habitats are Red Listed

Figure 1: Overview of Natura 2000 freshwater sites

Member States should undertake a structured assessment of whether existing designations provide adequate coverage of all freshwater habitat types listed in Annex I of the Habitats Directive. The assessment should consider not only total area but also ecological functioning. Designated areas must be large and coherent enough to maintain key processes, ensure connectivity and support viable populations of characteristic species.

Where gaps in overall coverage are identified, Member States should expand existing site boundaries or designate additional sites. This should be done strategically, with particular attention to river catchments and hydrological coherence, rather than through isolated or incremental additions. A catchment-based approach will improve ecological integrity and increase the effectiveness of both protection and restoration measures.

## Addressing representation gaps across biogeographical regions

In parallel, Member States should address gaps in the biogeographical representation of freshwater habitats. Several freshwater habitat types – particularly streams and small rivers – recognised in the European Red List of Habitats are not protected across their full natural range. In some regions they are absent from the Natura 2000 network altogether. This uneven coverage weakens ecological resilience and adaptive capacity under climate change.

A systematic review of Natura 2000 should verify whether each relevant freshwater habitat type is represented in all biogeographical regions in which it naturally occurs. Where representation gaps are identified, targeted designation of new sites, or adjustment of existing sites, will be required. This is particularly urgent for habitats already classified as threatened or declining.

Full biogeographical representation is necessary to secure long-term viability of freshwater biodiversity habitats at the EU scale. Without it, conservation efforts remain fragmented and less effective, and opportunities for species recovery and habitat restoration are reduced.

## Linking designation with restoration priorities

Effective freshwater protection and restoration within Natura 2000 will not be achieved unless these spatial limitations are addressed. Insufficient coverage and fragmented distribution constrain restoration impact. They limit connectivity, reduce ecological recovery potential and undermine cost-effectiveness.

This has direct implications for implementation of the Nature Restoration Regulation, which requires measurable and sustained ecosystem recovery over the coming decades. It also affects delivery of the Water Framework Directive, which depends on functioning and connected river basin systems.

Member States should thus align the recommended review of Natura 2000 freshwater designations with restoration planning. Expanding and optimising the network should go hand in hand with identifying where restoration can be delivered most effectively. Priority should be given to areas where ecological condition can be improved with feasible measures, where connectivity gains are high, and where co-benefits for biodiversity, climate adaptation and water management can be maximised.

## Supporting implementation: the MERLIN web app

The MERLIN web app ([waterwebtools.com/merlin](https://waterwebtools.com/merlin)) provides practical support for this process. It enables Member States to assess current habitat coverage, identify spatial and representation gaps, and identify restoration potential across both running and standing waters.

The tool supports evidence-based decision-making. It allows authorities to identify where Natura 2000 designation should be expanded, and where restoration actions are most feasible. Used alongside national datasets and River Basin Management Plans, it can strengthen the preparation of National Restoration Plans under the Nature Restoration Regulation.

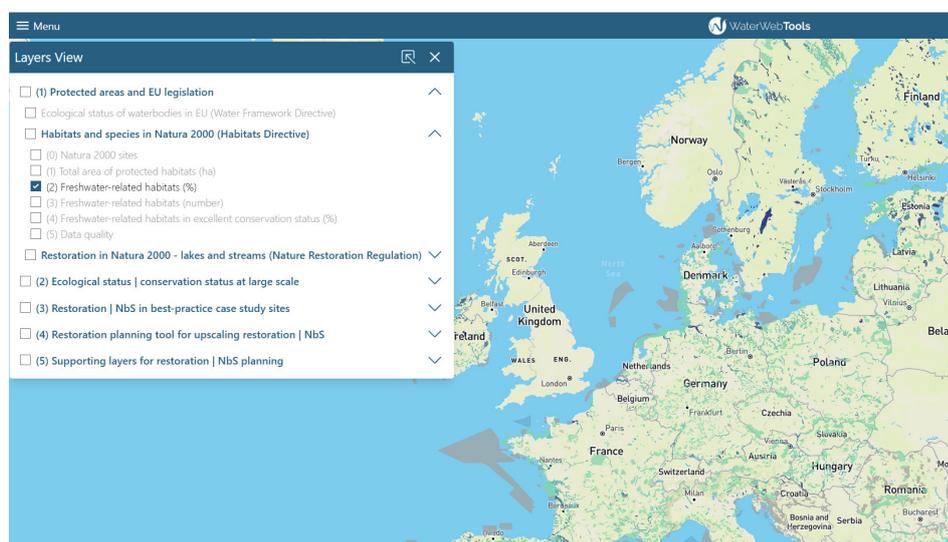


Figure 2: MERLIN web app

## Policy recommendations

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The European Commission should invite Member States to undertake a coordinated review of freshwater habitat designation within the Natura 2000 network. This review should assess the adequacy of spatial coverage and biogeographical representation across the network, and identify where expansion or adjustment of sites is necessary. This review should ensure that all European Red List freshwater habitats and species are protected across their full natural range.

The Commission should provide guidance to support this process. This should include methodological recommendations, the use of EU-level tools such as those provided by MERLIN, and alignment with existing policy frameworks, in particular river basin planning under the Water Framework Directive and implementation of the Nature Restoration Regulation.

Taking action now will improve ecological outcomes, enhance climate resilience and increase the efficiency of EU investment in biodiversity. It will also reduce long-term implementation risks and support coherent delivery of EU environmental objectives

## Acknowledgements

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## Further reading

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Baatrup-Pedersen, A., Baumann, M., Jensen, M. K., Trolle, D., & Nielsen, A. (2025). Maps of protected habitats and species in the Natura 2000 network - with emphasis on freshwater habitats, their restoration potential, and terrestrial groundwater-dependent ecosystems. [Data set]. Zenodo. <https://doi.org/10.5281/zenodo.17601833>

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Baumann, M., Nielsen, A., Trolle, D., Branco, P., Borgwardt, F., Hering, D., Birk, S., Baatrup-Pedersen, A. (2026). Restoration potential of protected freshwater habitats in Natura 2000 network. In preparation.