WHY IS NATURE RESTORATION CRITICAL FOR RIVER CONNECTIVITY?

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The EU has a target to reach good ecological status for all surface water bodies including rivers by 2015, at the latest by 2027, based on the Water Framework Directive (WFD). However, implementation of the WFD is lagging behind and enforcement must be stepped up. In 2015, only 44 % of EU water bodies were in good or better ecological status. The Biodiversity Strategy to 2030 called for greater efforts and concrete actions to restore freshwater ecosystems and the natural functions of rivers to support the WFD objectives. To restore the natural functions of rivers, the Strategy sets a target to restore by 2030 at least 25,000 km of rivers into free-flowing rivers through the removal of river barriers and the restoration of floodplains and wetlands.

Healthy rivers require a high degree of connectivity to support the complex life cycles of many aquatic species and a functioning ecosystem. Only with healthy, biodiverse water bodies can we allow nature to thrive, ensure clean and sufficient water supply, and resilience to climate change impacts [1].

River connectivity in Europe is hindered by a very large number of barriers on EU rivers (**at least 1.2 million barriers**) and it is expected that **only few EU rivers are at present free-flowing**. Relatively barrier-free rivers can still be found in the Balkans, the Baltic states, and parts of Scandinavia and southern Europe [2].

A significant number of these man-made river barriers could be removed, as they are no longer useful (obsolete barriers). The reconnected reaches combined with other river restoration measures can serve as habitats to restore the populations of several fish and other species.

Gäddede, Sweden, Photo by Jon Flobrant

WHAT CAN THE NATURE RESTORATION LAW ACHIEVE?

The Nature Restoration Law (NRL) asks Member States to make an **inventory of barriers to longitudinal and lateral connectivity** of surface waters and identify the barriers that need to be removed to contribute to the achievement of the NRL restoration targets for relevant habitats and species.

The requirement of the NRL to make an **inventory of barriers to longitudinal and lateral connectivity** is a crucial first step, because existing barrier records underestimate true barrier numbers with considerable variation between EU countries [3]. For barriers to lateral connectivity, there is no systematic overview or mapping at EU level to support the development of sound strategies for barrier removal and to monitor progress.

Restoring rivers to free-flowing state is designed to support and foster the achievement of the WFD objectives, as well as to boost broader river restoration efforts for the **benefit of habitats and species** [4]. The removal of barriers aims to help rivers **re-establish their natural water and sediment flow**, and **free-up migration routes of fish such as salmon, eel and sturgeon and other aquatic species**, whose habitats have become isolated through river fragmentation [5].

- River barriers have been identified as a **significant pressure under the WFD for at least 20% of EU river water bodies**, contributing to the non-achievement of good ecological status [6].
- The presence of river barriers also affects the condition and conservation status of protected habitats and species. Under the Habitats Directive, the top group of pressures affecting **freshwater habitats** is the **modification of hydrology and hydro-morphology** (with **over 33 % of all pressure records** reported as "high-ranking") including among others dams and reservoirs, drainage, water abstraction.
- Habitat fragmentation and the lack of connectivity in European rivers impacts river biota. Since 1970, **migratory freshwater fish in Europe declined by 93%** [7] to a large extent owing to the fragmentation of migratory routes.
- Until 2020, Dam Removal Europe [8] has documented the removal of at least 4,984 longitudinal barriers in selected countries. **Even a small number of strategic barrier removals can have a significant positive impact**: the Open Rivers Programme [9], for example, claims that by removing just 19 specific dams, the programme-supported projects will free 386 km of rivers [10].

Aosta, Italy, Photo by Mario Álvarez

- **Free-flowing rivers offer numerous benefits**, including improved fishery yields, regulation of floods, recreation, aesthetics, and water quality advantages. With increasing experience of barrier removals in Europe, evidence becomes available on the benefits of free-flowing rivers for humans, biodiversity, and landscapes. Several studies using monitoring data after **barrier removal measures show positive changes in fish communities**. For example, 30 years of data in Denmark reveal dramatic increase in abundance of the brown trout following dam removal (Birnie-Gauvin et al, 2017) [11].

The **status of river floodplains** is also closely linked to the free-flowing status of rivers. Measures taken to restore free-flowing rivers will contribute to the restoration of degraded floodplains and re-establish the connectivity of rivers to their floodplain.

- **70-90 % of European floodplains have been environmentally degraded** because of structural flood protection, river straightening, disconnection of floodplain wetlands from the river, agricultural land use and urbanisation over the past two centuries [12].

- **Only 17% of habitats found in floodplains are in favourable conservation status**, and for some large biogeographic regions no floodplain habitats are in favourable conservation status [13].

- Natural floodplains are important for biodiversity and many ecosystem services. **Floodplains host unique and diverse fauna and flora**. Floodplains provide ecosystem services like natural habitats, drinking water, carbon storage, flood protection, and recreation.

- If kept in a good condition or restored, the **carbon stock capacity of riparian, fluvial and swamp forests** is estimated to be between 6- 8 Gt CO2-eq and their **carbon sequestration potential** per year is calculated to range between 15,129 and 95,171 kt CO2 eq yr-1 [14].

Morava floodplain, Photo by Tomasz Anusiewicz

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