The network for best practices of river restoration in Greater Europe
ECRR
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Editorial

River restoration is a broad concept. In addition, it is an activity that is applied within the broad context of Integrated River (Basin) Management. As a result, river restoration touches on many different aspects. This is reflected in a wide variety of articles in the ECRR Technical Newsletter.

In this edition, too, the three articles presented are very different in nature. The first article describes how Norway has implemented a catchment-based approach to water management, involving local water boards and catchment coordinators.

The second article narrates the journey of a group of river restoration practitioners from Cumbria, England, who visited the Vjosa River in Albania, one of the most natural and biodiverse rivers in Europe, and how they exchanged knowledge and insights with the local team.

And the third article is about river continuity restoration best practice in Finland. It provides some examples projects in Finland, using natural by-passes and other technical solutions to remove or modify barriers and obstructions.

From these articles the conclusion could be drawn that Norway, Cumbria and Finland are leading the way in managing and restoring Europe's Rivers. But for other European countries, this can just as easily be said in relation to yet another completely different aspect, about which we'll publish other articles.

Bart Fokkens, ECRR

Strengthening local water governance in Norway through Catchment Coordinators

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Introduction

Water is essential for life, but also a source of many challenges. Water management is complex and requires the involvement of multiple stakeholders, levels of government, and sectors. How can we ensure that water is managed in a way that is safe, fair, and resilient to climate change?

One possible answer is to adopt a catchment-based approach, where water issues are addressed at the scale of the natural hydrological unit, rather than administrative boundaries. This approach can foster collaboration, participation, and innovation among the actors who share a common interest in the water resources of a catchment.

In this publication, we present the case of Norway, where a catchment-based approach with local water boards and dedicated catchment coordinators has been introduced in almost all of its 100 catchments. We describe the main features, outcomes, and lessons learned from this experience, and discuss its implications for water governance in Europe and beyond.

What is a catchment-based approach?

A catchment-based approach is a way of managing water resources that recognizes the natural boundaries of a river basin or a lake catchment, rather than administrative or political ones. It aims to integrate the management of water quantity and quality, surface and groundwater, and land and water interactions. It also seeks to involve all relevant stakeholders in the planning, implementation, and evaluation of water management actions, ensuring that their views, interests, and knowledge are taken into account. A catchment-based approach can have multiple benefits, such as:

- Improving the ecological status and resilience of water bodies and ecosystems
- Enhancing the coordination and cooperation among different authorities and sectors
- Increasing the public awareness and engagement in water issues and solutions
- Promoting the innovation and adaptation of water management practices to local contexts and needs
- Reducing the conflicts and trade-offs among competing water uses and users

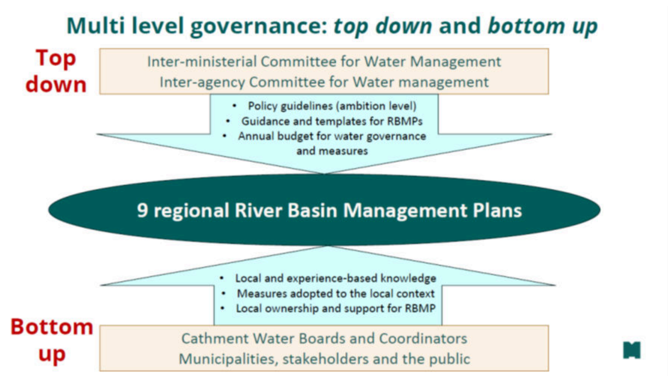

FIGURE 1 *Multilevel governance*

How does it work in Norway?

Norway has a long tradition of decentralized and participatory water management, dating back to the 19th century, when local water boards were established to deal with water-related problems, such as flooding, erosion, and pollution, but only in a few catchments with very significant challenges. However, the EU Water Framework Directive (WFD), implemented in Norway since 2007, which requires the achievement of good ecological status for all water bodies, posed new challenges and opportunities for water governance in Norway.

In order to comply with the WFD, Norway introduced a catchment-based approach with local water boards and dedicated catchment coordinators in almost all of its 100 catchments. The catchments are inter-municipal, meaning that they link municipalities and other stakeholders around shared water issues, across municipal boundaries and interests. The municipalities are important authorities, responsible for management of drinking water and wastewater, surface water runoff, impacts from agriculture, land use management in/along the watercourses, as well as smaller pollution issues.

FIGURE 2 *Halden Catchment*

The catchment coordinators (CCs) are a shared resource and expertise for the municipalities, assisting them with their responsibilities and tasks in water management, and contributing to public information, awareness raising, and participation. The CCs are funded through a joint venture between national, regional, and local authorities, and more than half of them are employed full-time, covering 1-3 catchments each, depending on the level of pressures and challenges. The CCs are considered a key factor for the success of water management in Norway, as they facilitate the collaboration and communication among the different actors and levels involved.

The tasks and coverage of the catchment coordinators are:

- The catchment coordinators
    - Are a shared resource and expertise for the municipalities in the catchments
    - Assist the municipalities with their responsibilities and tasks in the water management
    - Contribute to public information, awareness raising and participation
- There are more than 60 people employed as catchment coordinators: about half of them fulltime (covering 1 – 3 catchments each) and the other half part-time (in combination with other tasks in the municipalities)
- In 16 catchments there is a 100% position as coordinator, in 45 catchments there is a 50 % position and in 16 catchments there is a 33% position. A few catchments have an even lower percentage, due to limited water challenges,

Outcomes and impacts

The catchment-based approach with local water boards and CCs has been evaluated by several studies and reports, which highlight its positive effects on water governance in Norway. Some of the main outcomes and impacts are:

- Improved ecological status and biodiversity of water bodies and ecosystems, as a result of the implementation of measures to reduce pollution, restore habitats, and enhance connectivity
- Increased coordination and cooperation among different authorities and sectors, leading to more integrated and coherent water management plans and actions
- Enhanced public awareness and engagement in water issues and solutions, through the use of participatory methods, such as living labs, workshops, surveys, and campaigns
- Fostered innovation and adaptation of water management practices to local contexts and needs, through the use of local and experience-based knowledge, and the development of tailored environmental measures

FIGURE 3 *Hurdal and Vorma Catchment*

Lessons learned

The catchment-based approach with local water boards and CCs in Norway offers valuable insights and lessons for water governance in Europe and beyond. Some of the main lessons learned are:

- Facilitating public participation functions best at local level, where people feel a sense of belonging and responsibility to their local river and lake
- Local support is a key to good river basin management plans. Local participation allows for the use of local and experience-based knowledge and the development of environmental measures adopted to the local context

- Local 'ownership' in the municipalities and population gives credibility to the plans and loyalty to their implementation
- Continuity among the CCs is considered a particular success criterion. Permanent and predictable funding for CCs is necessary so that they can have permanent positions

FIGURE 4 *Hurdal and Vorma Catchment*

Conclusion

Water management is a complex and dynamic challenge that requires innovative and adaptive solutions. A catchment-based approach, where water issues are addressed at the scale of the natural hydrological unit, and where all relevant stakeholders are involved in the process, can offer a promising way to improve water governance and achieve the goals of water safety, fairness, and climate resilience.

Norway's approach to water management has been the establishment of a catchment-based (bottom-up) approach, with local water boards and dedicated coordinators securing the involvement of municipalities and stakeholders and enhancing public participation. However, the issue of sustainable funding and job security for the catchment coordinators remains a critical challenge.

The OECD Principles are a useful reference for systematic evaluation and improvement of Water Governance in Norway.

Norway is a leading example of how a catchment-based approach with local water boards and CCs can be implemented and deliver positive outcomes and impacts for water management. The experience and lessons learned from Norway can inspire and inform other countries and regions that are facing similar water challenges and opportunities.

From Cumbria to Albania: Learning from the Vjosa, Europe's Last Wild River

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Benoît Terrier — Figures 4, 5, 6, 8, 9, 10, 11

Introduction

The Cumbria River Restoration Programme, winners of the 2022 European River Prize, recently visited the Vjosa River team in Albania, fellow finalists of the prize. This visit allowed for the sharing of knowledge and collaboration, inspiring action and change for the Cumbrian rivers.

FIGURE 1 *Vjosa basin map*

Where rivers across Europe are often in a poor state, having been exploited historically they are now fragmented and largely non-natural, the Vjosa River is still one of the most natural watercourses left on the continent. The river and its floodplain have a high biodiversity, landscape value and cultural heritage. Several studies have shown the need to protect the Vjosa Valley as a protected area, based on the IUCN protected areas standards. The studies also examined the potential impacts of 45 planned dams on the river, which would disrupt ecological continuity, water quality, sediment transport and the livelihoods of local populations. The studies advocate the conservation of the Vjosa as a model of natural hydro-morphodynamics, a hotspot of endangered ecosystems, and a source of green tourism and sustainable agriculture.

For decades, the river was threatened by dams and mining activities. And NGOs formed a coalition to launch the "Save the Blue Heart of Europe" campaign, which has brought attention to the river and its surroundings. They have carried out several studies to document the ecological, economic, and cultural value of the Vjosa, as well as to demonstrate the negative impacts of 45 planned dams. They then influenced the Albanian government and the public to protect the Vjosa as a wild river national park, meeting IUCN standards for protected areas. Fortunately, the Vjosa is now by government decree protected and is the world's first river to become a national park, and is home to more than 1000 species, including rare vultures and Balkan lynxes.

FIGURE 2 *Upper Vjosa Boating trip*

Hydro-morphology

The watercourse drains an area of 6706 km². It rises in the Pindus Mountains on the border of Greece and Albania and flows for 270 km before finally discharging into the Adriatic Sea northwest of Vlorë. The watercourse is now the longest free flowing system left on the continent with minimal abstraction occurring and no dams or artificial barriers to flow present along the entire course of the river and its major tributaries.

FIGURE 3 *Vjosa riverbasin landscape*

Past glaciation has impacted the system, and many relict glacial and fluvio-glacial features can be seen along its course with the river flowing through bedrock gorges and wider valley floor sediment deposits to create a richly diverse hydromorphology. There are presently no permanent glaciers in the headwaters, but the flow regime is strongly influenced by snowmelt creating conditions conducive to prolonged elevated early summer flows. The alpine climate also results in high rates of weathering and sediment production in the upper catchment which is presently being supplied to the main river in very large volumes. In combination the presence of valley floor sediment stores, high rates of sediment supply and a seasonally energetic flow regime create perfect conditions for rapid and frequent channel change with the Vjosa exhibiting some of the best and least restricted lengths of braided channel in Europe.

FIGURE 4 *Teaching dynamic rivers*

During the tour the headwater systems was visited, witnessing the high levels of sediment production from the headwater tributaries, and observing how this sediment is rapidly moved down valley to the main river where it forms valley margin sediment stores, moved on during the snowmelt season. A boating trip through the steep, confined bedrock main channel in the upper reaches of the river revealed how energetic these reaches are, with water depths of up to 10 m described to the party by the guide. Such conditions allow sediment supplied from the upper catchment to move through to the wider sediment storage zones further down valley. Stops at several of these wider valley floor zones allowed the party to witness the extensive braided channel systems with their characteristic wide valley floor. Flow conditions were calm on the trip but it was clear how active the river was with multiple active gravel bars and sub-channels seen across the wide wetted channel. Areas of inactive braiding were also seen allowing the group to see how these areas were progressively exploited by pioneering plant species to generate a mosaic of habitats across the floodplain.

FIGURE 5 *Vjosa braided pattern*

George Heritage: 'Overall, the group were able to witness first hand, with the help of knowledgeable Albanian guidance, the fantastic diversity and activity of the Vjosa River, with the dynamics explained through an understanding of past and present influences on the flow and sediment regime of the system and everyone left inspired to translate their experiences towards restoration targets in the UK.'

Ecology and biodiversity

1175 species of flora and fauna have already been identified on the Vjosa catchment, including 257 species of birds and at least 31 species of fish (www.vjosanationalpark.al). The group had great expectations in terms of biodiversity for this study tour and was not disappointed. The Vjosa is a highly dynamic gravel-bed river, with significant bedload transport estimated to be between 48 000 and 125 000 tons / year (Hauer et al, 2019). This high sediment transport and dynamic environment leads to beautiful and large braided patterns in some reaches that offer a great diversity of habitat. Some of the bars on this river were obviously very mobile and some were colonized with pioneer vegetation. In many areas, the riverbanks are largely free of bank protection and undergo active lateral erosion. These unprotected banks provide nesting opportunities for some species of birds and nests of bee-eaters and sand martins were spotted in several places. Some oxbows crossed by the group were groundwater fed and were obvious hotspots of biodiversity.

Walking along the river in the mornings or in the evenings, the densities of birds and amphibians observed were amazing and great numbers of little ringed plovers were seen along river! Grey wagtails, bee-eaters, kingfishers, white throated dippers, green sandpipers, European stonechats, whinchat, hoopoes, black storks, grey flycatchers, honey buzzard, lesser kestrel etc. were just a few birds that were abundantly present. Also, many dragonflies were spotted, and some Hermann tortoises were observed along the river, without any difficulty. The Narta lagoon, in the Vjosë-Nartë delta protected area, is also known to be rich in biodiversity. It was hosting a colony of flamingos, a pelican, a great egret and many more birds on its shore when visited.

FIGURE 6 *Sunset on Vjosa near Përmet*

FIGURE 7 *Flamingos in the Narta Lagoon*

Benoît Terrier: ‘The Vjosa, has remained a wild river, free from dams and with long reaches free from bank protection. Its ecological quality is simply amazing! Observing Vjosa’s ecosystem made me realize the huge loss of biodiversity that followed the damming and channelization of many braided rivers in the Rhone basin where I am from, and on the Durance catchment, in particular (South-East of France). This journey has been a great medicine against the environmental amnesia and the shifting of our reference conditions that has occurred in western European degraded hydrosystems’.

FIGURE 8 *Little ring plover*

FIGURE 9 *Narta Lagoon, Vjosë-Nartë Delta*

FIGURE 10 *Urea e Bratit bridge over the Vjosa, Brataj near Vlorë, Albania*

Bringing 17 Cumbria River Restoration programme national and international partners to the beautiful River Vjosa in Albania, was one of the highlights of their river restoration careers. Starting the trip near Përmet on the border with Greece, following the winding, expansive river through historic towns and villages across the country, to where it finally meets the Sea in Vlorë. They did not only get to see Europe's most natural river, but also met some of the friendliest people and ate some of the freshest, most delicious food they have ever eaten! Having Olsi Nika from EcoAlbania join the group for a day proved really beneficial, he kindly invited the group to their research base in Telepenë to meet some of his colleagues and he told about all of the amazing work they have been doing to protect this majestic river in recent years. And about the research and monitoring programme that they are going to carry out for the future management of the complete river system.

FIGURE 11 *Vjosa Research Centre, Tepelenë, Albania*

FIGURE 12 *Village lunchroom*

Olly Southgate: 'Although seeing this amazing river was the ultimate aim of this trip, the opportunity as a partnership to collaboratively discuss all things river restoration related outside of the usual online meetings was one of the greatest outcomes of this epic adventure. If only we could have stayed longer.'

FIGURE 13 *Riverside classroom*

Aalto University

The network for best practices of river restoration in Greater Europe
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Breaking News: River Continuity Restoration in Finland

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Photography

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Hanna Ollikainen	Figure 2
Mika Ylisaukko-oja	Figure 11

Introduction

Creating habitats for reproduction of salmonid fish is one of the main interests of river (continuity) restoration in Finland. Dams are removed also in cases where small hydro power has still been operating and the results for fish are promising. In cases where hydropower will stay, bypass channels have proved to be successful for migration and also reproduction. Bypass channels can compensate the loss of natural spawning sites for some extent but how much, needs still research. Interest is rising also for constructing new spawning brooks in more natural environment. Restoring rapids with environmental flow is an increasing interest at rivers with hydropower. Preventing impact of floods for juvenile production in rapids still needs more research. This article highlights some of the recent successes in the field if this type of river restoration.

FIGURE 1 *The different project locations: 1. Hiitolanjoki 2. Ämmäkoski 3. Imatra city brook 4. Capeenpuro 5. Rantavaara*

Dam removals of the river Hiitolanjoki

One of the most famous restoration projects, in Finland, decommissioning of three functioning small hydropower plants at the river Hiitolanjoki at the eastern border, came to its final stage in November 2023. The dam of the Ritakoski power plant was opened and the rapid was restored. The river is now free for the migration of the landlocked lake salmon stock of the Ladoga Lake in Russia. The powerplants were bought for a local recreation area foundation and the restoration sites are open for public.

FIGURE 2 *The upmost dam of the river Hiitolanjoki at the Ritakoski power plant was opened*

The restoration project could be followed in the news for three years. The dam at the Lahnasenkoski powerplant was removed and the rapid was restored in 2022. During the ongoing restoration, workers could see spawning salmon practically between their feet in the rapid.

FIGURE 3 *The restored Lahnasenkoski rapid, with the decommissioned powerplant and removed dam*

The Kangaskoski power plant was decommissioned and the dam was opened in 2021. The site is one kilometer from the Russian border and the salmon and fish could migrate only to the powerplant in Finland. The fish were waiting for the possibility to migrate and spawn. After restoration, the densities of salmon and brown trout juveniles in the rapid have been exceptionally high, in the best sites up to 200 juveniles/100 m^2. New spawning areas were taken in use immediately with good spawning success. Now there are also further spawning areas available at the upper watercourse.

FIGURE 4 *The restored Kangaskoski rapid with the opened dam*

Restoration and environmental flow of the Ämmäkoski rapid, Varkaus

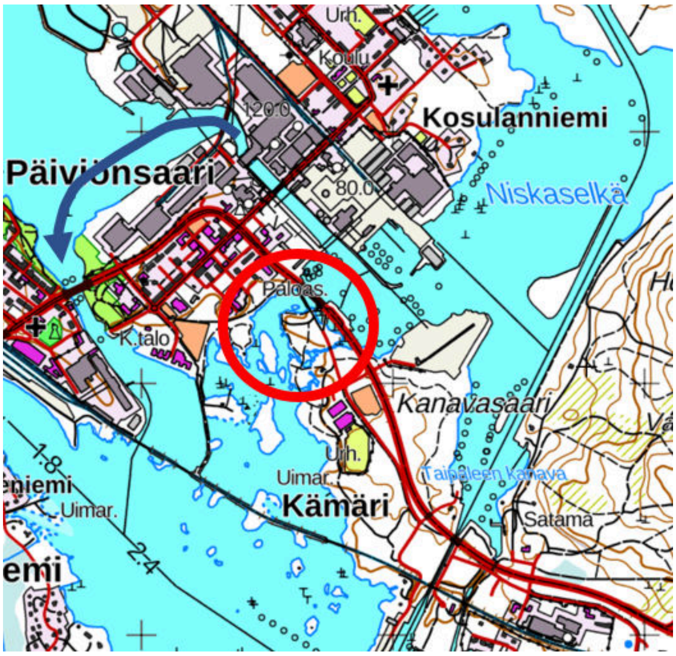

FIGURE 5 *Location of the Ämmäkoski rapid (red circle) in the Saimaa Lake system between two lakes*

Varkaus city is in the middle of the Saimaa Lake system, which flows through Ämmäkoski rapid (Figure 5, red circle). The lake above needs regulation for navigation. Most of the discharge goes through a powerplant (Figure 5, blue arrow) and the main inland ship route with sluice are on the other side (Figure 5, at the right).

The rapid is 5 metres high and it was once a famous fishing site of brown trout and lake salmon. Most of the discharge is lead through the hydropower station. This means that the rapid was almost always dry, except on high flow periods.

The aim of the project was to create a free migration route and reproduction area for brown trout, the vulnerable Saimaa Lake salmon stock, and all other migrating species. City of Varkaus wanted also to enhance the rapid riverscape for residents.

Decommissioning of the 4 MW power plant was proposed because fish are attracted to the power plant. But another option was chosen, to lead an environmental flow of 10 m³/s to the rapid, of which half comes through a bypass channel. This is about 10 % of the mean discharge of the watercourse. This was voluntarily given by the power company.

FIGURE 6 *The bypass channel flows around the regulation dam*

Also flood discharges in the rapid attracts fish. The rapid bed was restored in 2022 as a fish reproduction site with the planned environmental flow. A bypass channel with length 160 m and discharge 5 m³/s was constructed around the regulation dam. Some trout fishes were caught under the powerplant and were relocated into the bypass channel.

FIGURE 7 *The central arm of the Ämmäkoski rapid*

A live video survey was installed in the bypass channel in autumn 2023 by WWF Finland. The location of the camera was successful. Active excavation of a spawning nest and spawning of trouts could be observed. Also, other fish species like pike, rainbow trout and whitefish were seen. A typical bird at rapids, white-throated dipper, was diving. Best moments of the video can be seen here: [Kala – WWF:n Luontolive – WWF].

FIGURE 8 *Spawning trout fishes in the live video of WWF Finland*

Circumstances in the bypass channel are steadier than in the rapid, where discharges change from the minimum to flooding. Reproduction success of fish will be monitored in the rapid and in the bypass channel, beginning by the research of spawning nests. It is already evident that the bypass channel is an essential part of the restored rapid system as migration route but also as a new reproduction habitat.

Imatra city brook

The Imatra city brook was constructed in 2014 to be a spawning site for the local brown trout of Vuoksi River, which leads the waters from the Saimaa Lake system. The results for trout juvenile production have been similar to the best trout rivers in central Finland (See: Journal of Ecohydraulics). In the autumn 2023 the number of spawning nests showed increasing to more than double compared to previous years. One explanation can be that trout fishes which were born in the brook have now become to an age of reproduction and they are coming back for spawning.

FIGURE 9 *Imatra City brook is getting more spawning trout fish*

Capeenpuro brook in Laukaa

The Imatra City brook has given inspiration for other Finnish projects to increase natural reproduction of trout. The Capeenpuro brook was constructed in 2023, with some finalizing activities in 2024. The site was a fish farm for production of mainly brown trout juveniles for stockings until 1990's. The one-kilometre-long canal of the water intake pipe for the fish farm was excavated and modified to be a spawning and rearing habitat for trout. Monitoring of fish colonization will follow in 2024. The brook will be a side channel for a natural rapid nearby, which has been restored for trout. Comparison of rapid and brook habitats will be one aim for research.

FIGURE 10 *Capeenpuro brook is constructed for brown trout*

Rantavaara spawning brook

The former fish farm Rantavaara was modified in 2023 to a spawning brook in Pello, Finnish Lapland. The discharge of the brook is 0.3 m^3/s. The site is near to the estuary of river Naamijoki into the river Tornionjoki, which is the most important salmon river at the Baltic Sea. Sea trout migrates into Naamijoki and the new spawning brook is especially planned for enhancing reproduction of trout in the river. Next years will show if trout fish find and accept the new habitat.

FIGURE 11 *Rantavaara fish farm is modified to a trout spawning brook system*

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