The network for best practices of river restoration in Greater Europe

ECRR
European Centre for River Restoration

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Contents

Editorial

With this newsletter we would like to inform you that we are convinced that we are facing both real great developments for river restoration as challenges that these entail, because the European Commission published in June 2022 a draft proposal for a 'Regulation on nature restoration – Nature Law'. This proposal for the regulation sets out an overarching objective of ecosystem restoration. To achieve this objective, the proposal sets multiple binding restoration targets and obligations across a broad range of ecosystems. The regulation proposes in particular a binding target of restoring 25,000 km of free-flowing rivers before 2030.

FIGURE 1 *I.S. Rivers 2022: Free-flowing rivers workshop practices with dam removal in the Yzeron river in Lyon, France.*

The ECRR would like to reiterate that its members are excited to see that the proposed regulation emphasises the restoration of freshwater ecosystems, which are one of the flagshfip ecosystems in the 'EU Biodiversity Strategy for 2030', and in particular the key objective of the restoration of at least 25,000 km of free-flowing rivers.

In order to support the elaboration and subsequent implementation of the regulation ECRR was the (co-)organiser of two workshops organized in the last half year, these were:

1. Free-flowing rivers and restoration of river connectivity: from theory to operational approaches. This workshop was held at the I.S. Rivers 2022 Conference in July, in Lyon, France.
2. River restoration: a European goal at the crossroads of several legislations. This workshop was held at the Europe-INBO 2022 Conference in September in Annecy, France.

This technical newsletter contains an article about each of the workshops. The main conclusions of both workshops were positive concerning implementation of EU legislation. We strongly recommend to read the highly readable articles for more insight in the different aspects of freshwater ecosystem restoration by the elaborative and integrative implementation of the EU water and nature legislation of which the (draft) Nature Law as a draft is still under discussion. We wish you a very instructive reading.

Karolina Gurjazkaitė, ECRR
Bart Fokkens, ECRR
Francisco Martinez Capel, CIREF

I.S. Rivers Conference, Lyon, France

ECRR workshop "Free-flowing rivers and restoration of river connectivity: from theory to operational approaches"

Introduction

On 4th July, river researchers and practitioners gathered in Lyon, France to attend the I.S. Rivers 2022, an integrative science conference. On its first day, ECRR with partners organised a workshop titled "Free-flowing rivers and restoration of river connectivity: from theory to operational approaches", attended by 50 river professionals. It focused on EU Biodiversity Strategy, and specifically on its goal to restore 25,000 km of free-flowing rivers by 2030. The goal ought to be achieved primarily by removing obsolete dams and other longitudinal barriers, as well as removing or displacing lateral barriers, thus restoring floodplains and wetlands.

Despite the undeniable inspirational ring to it, there are still several issues on a practical level that river managers may stumble across. **What is a free-flowing river; how do we define them?**

FIGURE 2 *The goals to restore our freshwater ecosystems have entered our policy, and they call for greater river connectivity restoration efforts.*

Barriers in the rivers of the EU number a truly overwhelming 1.2 million, recent research shows (AMBER project findings). Many of them are obsolete and no longer needed to generate renewable energy, for water supply, or other uses. As soon as one considers the number of barriers, the limits on available resources and

ovals, a great need becomes evident for a strategic approach. **To open our rivers effectively, it is indispensable to prioritise the barriers for removals.**

FIGURE 3 *The view of the restored river Yzeron, a heavily modified water body, a right bank tributary to the Rhône.*

FIGURE 4 *The view of the dammed river prior to restoration.*

After some context setting, the workshop took place in two parallel groups. The first group discussed possible metrics for the assessment of free-flowing rivers. The second group discussed approaches for the prioritisation of barrier removals. The outputs of these discussions could aid the Member States in a more efficient implementation of the Strategy, and the EC in improving its guidance.

Discussion group 1: Metrics for "free-flowing rivers"

The EC guidance for barrier removal proposes to primarily focus efforts on longitudinal and lateral connectivity and mainly interprets 'free-flowing' rivers (FFR) as surface water bodies that are not impaired by artificial barriers and not disconnected from their floodplains. However, such approach is limited as it does not consider main river functions and ecosystem services. And although the EC guidance preliminarily introduces general principles and concepts, such as 'functional river units' (FRU) to guide Member States in the development of projects and programmes, the development of concrete methods and tools to make the 'free-flowing river' concept operational is still an open task inviting discussion.

A. Goltara: Why do we need a metric for free-flowing rivers? Which components of connectivity to include in such metric?

The discussion was led by Andrea Goltara (CIRF, Italy). There was an agreement among workshop participants that the FFR metric should foster effective barrier removal efforts and would promote conservation of currently connected river reaches. The metrics should also incorporate all the main river functions affected by connectivity.

All participants agreed that the metrics should include the following components:

- longitudinal connectivity for fish (upstream/downstream);
- longitudinal connectivity for sediments;
- lateral connectivity in relation to ordinary (2 to 10 years) flooding processes;
- lateral connectivity in relation to riverbed mobility/lateral erosion.

Longitudinal connectivity should be based on the presence/absence of specific barriers. For

lateral connectivity, the approach should be different. The total absence of obstacles is not foreseeable in many cases; instead, river type/size-specific thresholds should be defined in terms of minimum lateral space available for the relevant processes (flooding/erosion) for a river (or reach) to be defined as free-flowing.

Prof. Carlos Garcia de Leaniz: What are Functional River Units: why do we need them? And how can they be defined?

Prof. Carlos Garcia de Leaniz (Swansea University, UK) proposed the Functional River Unit (FRU) concept, i.e. the minimum river length that should be considered for a stretch to qualify as free-flowing. An FRU should sustain the targeted river functions and ultimately a healthy ecosystem, and contain specific physio-chemical, hydromorphological, and biotic characteristics.

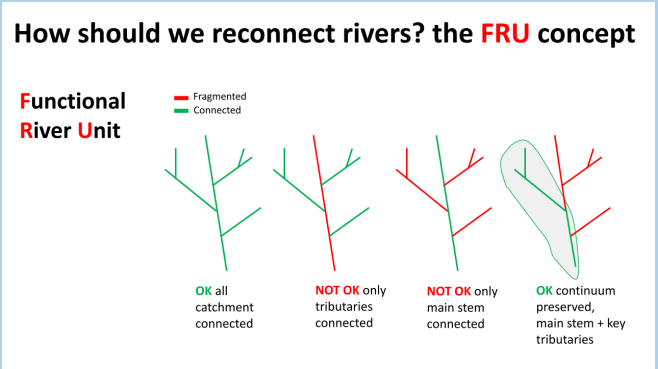

FIGURE 5 *The FRU (Functional River Unit concept) requires restoring connectivity either of the main stem and tributaries, or of the entire catchment. Garcia de Leaniz, Swansea University.*

Discussion

Most participants agreed that the water body is not the right scale for the assessment of FFR and that it is reasonable to consider the quality (in terms of the river functions) of the reconnected reaches. Minimum levels of functionality in relation to connectivity should therefore be defined.

However, it was unclear if the approach can be extended to all relevant processes, i.e. longitudinal connectivity for sediments. For example, in Figure 5, the sketch on the right describing "*OK, continuum preserved, main stem and key tributary*" can in principle be extended to sediment transport processes, but only when the tributary has the right conditions for this.

There was no consensus among participants on the use of the WFD "good" status or the conservation status according to the Habitat Directive of water bodies to evaluate the "quality" of the reaches, as threshold for the applicability of the FFR status to a connected reach/FRU.

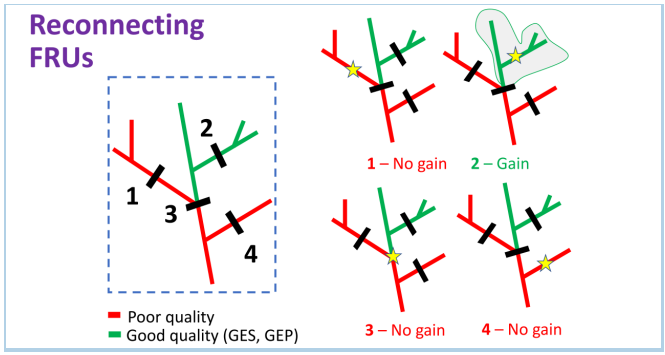

FIGURE 6 *The concept of restoring river to a "free-flowing state" should focus on restoring functional river units. Garcia de Leaniz, Swansea University.*

Still, one might consider the ecological reference to be the basis: when the barriers are removed and good ecological status is reached, then our goal is met in terms of connectivity restoration. While not a perfect score on all counts, it is what is needed at least as a start.

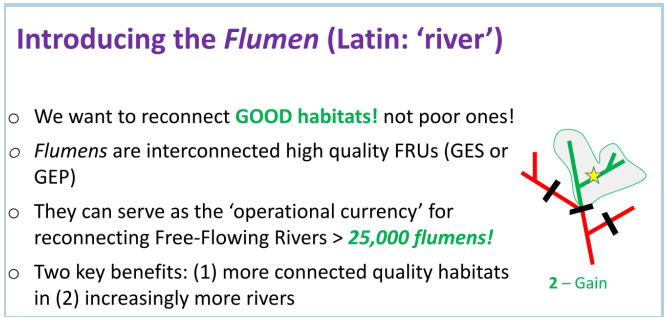

FIGURE 7 *Connected rivers with Good Ecological Status / Potential. Garcia de Leaniz, Swansea University.*

Discussion group 2: Prioritisation of barriers and rivers for restoration measures

J. Royte: Prioritisation methods and needs

The second session was based on two presentations about prioritisation methods. The first speaker, Joshua Royte (TNC, USA), presented some prioritisation methods that exist to date, as well as some key lessons and needs related to them.

The methods share some similarities regarding metrics, criteria, and data. Virtually all methods focus mainly on longitudinal connectivity for fish and in a certain way consider priority species, the number of barriers either upstream, downstream, or to the sea, the potential for kilometres of rivers (and hectares of habitat) opened if a barrier is removed, and the financial efficiency of the project (km/€).

An important distinction emerged among the methods. Some of them aim to prioritise barriers for removal based on the (highest) ecological outcome while the others optimise the choice of specific barriers for highest ecological gains, but this time the choice is specifically constrained to fit in a specified resource budget. However, then the ecological gains may be lower than priority barriers.

Some methods have unique features. For instance, West Atlantic models prioritise dams and culverts, unlike many other methods, that only look at dams. The Finnish method developed by SYKE considers fish population potential and hydropower based on their predicted future net value.

Royte concluded that it was important to start incorporating the effects and stresses brought by climate change into prioritisation for river restoration.

FIGURE 8 *A barrier removal taking place on the first day of the I.S. Rivers 2022 conference.*

Dr. F. Magdaleno: prioritisation approaches in Spain

The second speaker was Dr. Fernando Magdaleno (Ministry of Ecological Transition and the Demographic Challenge, Spain). He presented the Spanish strategy for river restoration. In 1989-2020, Spain successfully removed over 300 barriers and installed 240 fish passes. In the near future, 108 barriers are planned to be removed.

Spain prioritised:

- water bodies (WBs) with those barriers that were priority for removal or permeabilisation as part of the Programme of Measures of the River Basin Management Plans;
- WBs that were in protected areas;
- WBs with barriers whose removal or permeabilisation would maximise unfragmented river length;
- WBs with significant fish populations that are threatened with invasive species;
- WBs particularly sensitive to climate change.

Magdaleno shared that not all high-priority barriers could be removed due to limiting factors such as social opposition or risk of spreading of invasive species. He stressed that event-

ually, decisions for each barrier must be taken individually.

Discussion

The developer of the Slovenian prioritisation tool, Dr. Polona Pengal (REVIVO, Slovenia), shared that insufficiency and scatteredness of data is a major hindrance in prioritisation, and this issue should be addressed by developing better databases of barriers, habitats, information about surrounding infrastructure, and other attributes.

Prof. Piotr Parasiewicz (Sakowicz Inland Fisheries Institute, Poland) suggested that vulnerability of fish communities to barriers could be included in prioritisation studies. There were also several suggestions to include metrics on sediment connectivity in the prioritisation tools, given that sediment discontinuity is a growing issue.

The negative perception of barrier removals in some communities was also discussed. To seek consensus between the data and the stakeholders, it is important to involve the stakeholders in the prioritisation. In his presentation, Royte noted that prioritisation tools should be tailored to multiple users' needs. This leads to the need for multiple prioritisation methods, which reflect the different parameters and needs of different stakeholders, e.g. cost and social values. He added, however, that prioritisation alone will not be sufficient to achieve the desired ecological goals, and there is a need for better communication and community engagement, as well as other measures to improve socio-political conditions for barrier removals.

FIGURE 9 *Photographs showing river restoration works in Lyon.*

Click here for full report

Europe-INBO Conference, Annecy, France

ECRR co-hosted workshop "River restoration: a European goal at the crossroads of several legislations"

Introduction

Annecy, a small and cosy town in the eastern part of France, became a meeting point for professionals from national and regional water directorates, administrations and basin organizations, as the 20th Europe-INBO conference took place in September 2022. The conference concerns with basin management on the basis of the implementation of such policies as the Water Framework Directive. It aims to foster discussion, address challenges, and facilitate the sharing of best practices.

During the first day of the conference, ECRR co-hosted a workshop on putting European river restoration ambitions into practice. As the title of the workshop suggests, river restoration is at the crossroads of old and new legislations, as well as national and international legislations and policies.

Valentina Bastino, the representative of the European Commission opened the workshop with the ambitions and actions the EU has taken towards river restoration. River restoration, as well as sustainable and balanced use of rivers has been on the agenda of the EU Water Framework Directive (WFD) for 20 years. In addition, protection of river ecosystems and species has been targeted by the EU Habitats Directive (HD), and multiple smaller regulations, like Eel Regulation and Pan-European Action Plan for Sturgeons. Regardless the multiple efforts, the situation of rivers in the EU is worrying – only about 40% of them meet the criteria for good ecological status.

Not only do EU rivers continue to deteriorate, but there are also growing pressures from climate change. EU calls for stricter action towards restoring ecosystems and sustaining rivers for multiple uses. According to Bastino, river restoration requires integrated efforts and working on two fronts, the WFD and the Habitats and Birds Directive. Not coincidentally, in 2020, river restoration climbed to the top of the European Green Deal agenda and the

2030 Biodiversity strategy agenda and produced the goal of restoring 25,000 free-flowing rivers to benefit water and related ecosystems.

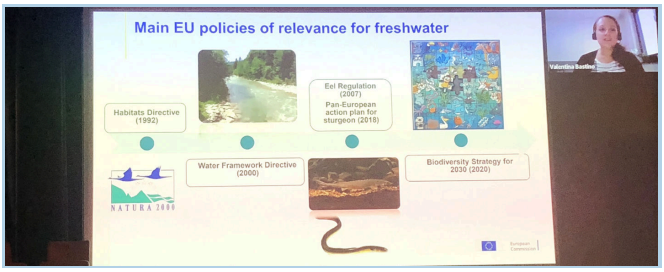

FIGURE 10 *Valentina Bastino, EC, presented main EU policies that aim at improving freshwater ecosystems.*

It is not a coincidence that the conference was hosted in France. France is one of Europe's leaders in restoring rivers, and in Rhone basin alone, during the last 8 years, river connectivity has been restored at 1,186 dams and weirs. Another presentation in the introductory sessions was given by Benoît Terrier, Rhone-Mediterranean and Corsica Water Agency, France. He presented lessons learned from the long-term water management experience in Rhone basin, France. The key to such success was linking water legislation with other sector policies for river restoration, e.g., agricultural pollution issues were tackled through CAP and agri-environmental subsidies for farmers.

Finally, Bart Fokkens, European Centre for River Restoration, touched upon the conclusions from the I.S. Rivers conference workshop, which had featured a discussion on putting theoretical river restoration approaches into practice. He was very positive about the EU's new ambitions regarding restoring 25,000 km of free-flowing rivers (FFRs), primarily by removing obsolete barriers and reconnecting rivers to their floodplain. Meanwhile, however, he noted that an up-to-date quantitative definition of an FFR is lacking. By solely removing dams we are not going to achieve improved water quality. In the context of river restoration, considering a river as an unfragmented water body is not sufficient, because its functions are not adequately considered. FFRs should sufficiently ensure ecosystem functions, such as the free flow of water, sediments and fish, and regular flooding processes. Therefore, restoration efforts should focus on restoring "functional river units" rather than water bodies. These units should encompass all processes, water and sediment flow, biodiversity, regular floodings and at least fish. These ideas are explained in the other article of this newsletter, dedicated to the workshop on free-flowing rivers and restoration of river connectivity, celebrated in the frame of the I.S. Rivers 2022.

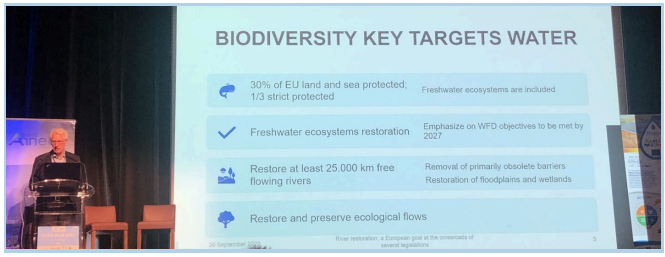

FIGURE 11 *Bart Fokkens, ECRR, presenting some outcomes of the I.S. Rivers 2022 conference at the EURO-INBO conference workshop.*

In this newsletter, we would like to introduce you to 3 project cases that were presented during the Europe-INBO conference. These cases illustrate the best practice for meeting different goals of different legislations, addressing river and ecosystem health with societal needs, namely, flood protection and other uses.

Case study: LIFE CONNECTS – towards restored ecosystem services in rivers

Karin Olsson, County Administration of Skåne, Sweden

LIFE CONNECTS (lifeconnects.se) is a LIFE Nature project that started in 2019 and will go

on until 2025. The aim of the project is to restore rivers in southern Sweden to improve ecological status, the conditions of habitats and species, and in the long term the preservation of ecosystem functions and services of freshwaters in Sweden and elsewhere.

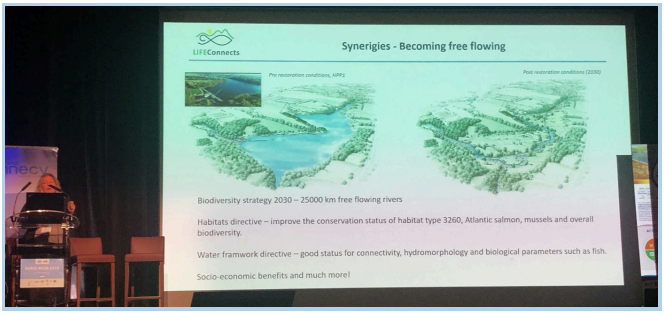

FIGURE 12 *Karin Olsson presenting the LIFE CONNECTS project in the EURO-INBO conference.*

Already when applying for a project from the EU commission (CINEA), the different directives and strategies are of great importance. When deciding where the restorations will be done, the ecological status (after the WFD) and the conditions in the Nature 2000 areas (based on the HD) are reviewed, to see which water bodies have less than good status and poor conditions according to habitat types or species connected to rivers. In LIFE CONNECTS, the status of connectivity and hydromorphology are especially considered. Then, it is also examined the suit of measures needed to improve the status and/or conditions, by looking at the program of measures (WFD) and conservation plans (HD) and recently also the Biodiversity strategy 2030 (BDS). This is to ensure best practices are used and the measures are well targeted to achieve the project goals.

When working in projects like LIFE CONNECTS, several objectives and environmental pressures at the catchment scale should be addressed. Often measures targeting different pressures are needed or advisable in the same water body, and this is to be considered during the project planning. In this way it is possible to come up with restorations aiming to improve the ecological status and conservation status as well as national goals like "Flourishing Lakes and Streams" and "A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos". By looking at the larger picture, i.e., the catchment area instead of individual water bodies, some synergy and cost-effectiveness can be enhanced in the project.

To be able to restore ecosystem services in rivers it is necessary to restore the functions of the river. For the river to be able to provide ecosystem services such as food, recreation, etc., the ecosystem needs to have the functions necessary to provide these services. To be able to provide food, e.g., fish, it will be crucial that there are free migratory pathways, natural hydrological regimes, connectivity with spawning and rearing grounds and a water quality good enough for the fish and other organisms, i.e., food for the fish, to live and thrive in the river.

LIFE CONNECTS will remove barriers, create fauna passages, and restore habitats to improve the connectivity and hydromorphology in seven rivers in the southern parts of Sweden. In the project, we will also reintroduce two of the endangered mussel species, the freshwater pearl mussel (*Margaritifera margaritifera*) and the thick shelled river mussel (*Unio crassus*) into localities where it has gone extinct or is present in very low numbers with only old mussels. Of course, it is important to incorporate the stakeholder involvement and public participation to be able to implement the actions in the project. A lot of communication and information activities will be conducted to raise awareness and ensure the involvement of different interests, so that the measures are well arranged before the implementation.

By working together – authorities, scientists, industry, NGOs, stakeholders, and the public – and by combining different directives and strategies, we can strengthen the work towards a sustainable water management and healthy rivers providing us with the ecosystem services needed by the society.

FIGURE 13 *Dam removal in Marieberg conducted during LIFE CONNECTS project.*

Case study: Life Iris: Integrated river solutions in Austria, linking regulations: synergy of ecology and flood protection

Kristina Schaufler, Umweltbundesamt, Austria

Water management in Austria

In Austria over 50% of rivers fail the objectives of the EU Water Framework Directive (WFD), mostly due to hydromorphological alterations.

Flood protection measures are the main driver for hydromorphological alterations in Austria. Over 70% of the water bodies in (or intersected with) areas of potentially significant flood risks fail the objectives of the WFD.

Water law is federal, but most of operational duties are assigned to provinces and municipalities. The WFD and the Floods Directive (FD) implementation is facilitated by the Federal Ministry for Agriculture, Forestry, Regions and Water Management, that sets the framework on a strategic level including funding regulations, whereas the planning and implementation of measures takes place on a provincial or municipality level.

Competence in river ecology and flood protection resides in different units. Nature conservation and spatial planning law is under the jurisdiction of the provinces (9 different laws each). Some measures in rivers can even be contradictory due to this lack of alignment.

There is an urgent need for harmonized planning procedures for rivers, to integrate both planning tools: 1) the Water Framework Directive and River Basin Management Plans and 2) the Floods Directive and Flood Risk Management Plans.

Only by overarching, conceptive and integrative planning at the catchment level can we achieve multifunctionality in river systems. To achieve this, the "Water Development – Risk Management Concept (GE-RM)" has been introduced and is currently implemented in pilot projects in LIFE IRIS (www.life-iris.at).

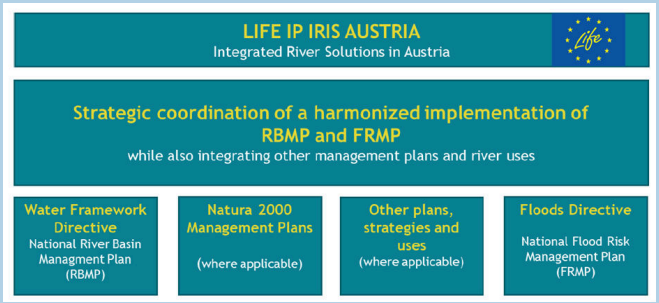

FIGURE 14 *Life IP IRIS project integrates multi-sectoral goals.*

Overarching goals

The 2030 Biodiversity Strategy lists goals to "restore degraded ecosystems and stop any further damage to nature" and to "restore at least 25 000 km of the EU's rivers to be free-flowing". In alignment, integrated management follows these goals to improve river ecosystems.

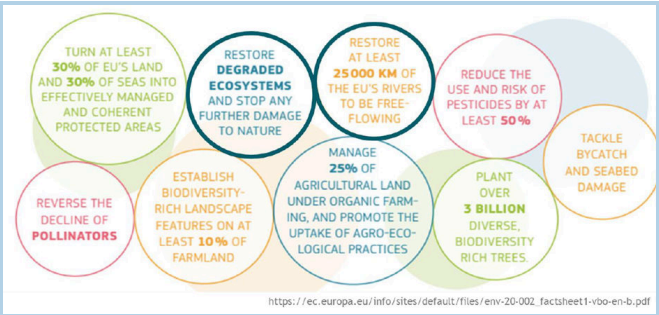

FIGURE 15 *EU Biodiversity strategy goals.*

Water Development - Risk Management Concept (GE-RM)

Austria is striving towards integrated river management and the strategic coordination of a harmonized implementation of RBMP and FRMP while also integrating other management plans and river uses with a new tool: the integrated planning guideline **"Water Development – Risk Management Concept (GE-RM)" (see Fig. 16).**

The GE-RM planning process encompasses four steps:

1) a **preliminary study** of the project area, that contains the project design and the delimitation of the scope of work, setting the scene and defining the project area.
2) an **interdisciplinary inventory** and analyses of existing data, as a status analysis. This step also includes additional data collection and processing.
3) to define goals and **integrative objectives**, a multidisciplinary coordination process is facilitated. A broad range of stakeholders is included, with the attendance of the administrative bodies responsible for both the Water Framework Directive and the Plus Directive as a minimum requirement.
4) the development of the **action plan** is also based on an interdisciplinary co-ordination process and stakeholder involvement. The document contains single measures or groups of measures for the whole project area, as well as the justification for selection of measures, cost estimation and prioritization.

Application in LIFE IP IRIS

In the LIFE IRIS project (Integrated River Solutions in Austria) the GE-RM planning process is being applied and tested in 7 selected catchments and for a total length of 595 km river stretches, with a project budget of €16.5 million (€9.9 million LIFE Funding). Led by the Federal Ministry for Agriculture, Forestry, Regions and Water Management (BML), 9 partners facilitate the project. Austrian federal districts, Viadonau and the Environment Agency Austria cooperate in LIFE IRIS. The project lasts for 9 years until 2027.

The in-situ application of the newly developed planning process provides valuable lessons learned to refine GE-RM guidelines for future implementation in Austria. LIFE IRIS applies

integrative measures (best-practice examples with synergistic ecology-flood protection) in the IRIS rivers while using a new concept for integrative monitoring.

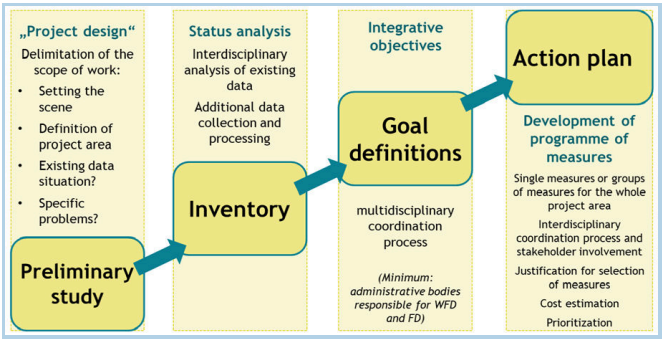

FIGURE 16 *The GE-RM planning process.*

The monitoring concept reflects the integrative perspective measuring impacts on ecology, flood protection, socio-economy, ecosystem services and socio-cultural aspects. It contains newly developed methods specifically designed to evaluate measures, as well as well-established methodologies and recommendation on their respective application.

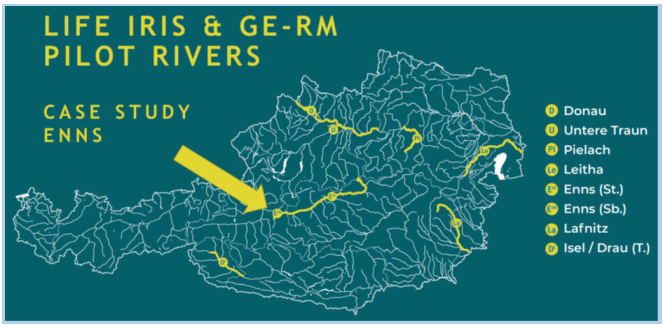

FIGURE 17 *Life IRIS & GE-RM pilot rivers.*

Regular networking meetings ensure the continuous collection of lessons learned and potential improvements to the GE-RM planning process, as well as better and simpler administrative coordination. The revision and improvement of GE-RM guidelines based on these important lessons learned will be a valuable result in the final phase of the project.

LIFE IRIS: Practical example, River Enns pilot project

The river Enns in Salzburg has been heavily straightened and regulated for flood protection. Within LIFE IRIS the restoration of an old meander is planned. The pilot measure is 800 metres long and is located close to the Mandlinger Moor.

The measure aims to improve freshwater ecology and hydrology while taking the nature-protected bog nearby and the potential of ecosystem services and tourism into account.

The pilot project reflects the overarching GE-RM planning for river Enns to develop the overall character of the river towards its pre-regulation state, while also following a core principle of GE-RM: *“Room for rivers” – the “Ecologisation” of flood protection.*

The effects of LIFE IRIS measures are evaluated in an elaborate pre- and post-monitoring to best learn from the implementation of measures.

At river Enns, hydromorpholgy, ecosystem-services, hydrology, fish, macroinvertebrates and dragonflies were part of the pre-monitoring.

Evaluation methods for seven indicators were developed or adapted to cover different aspects of the measures. Monitoring includes hydro-morphology, eco-system-services, hydrology and flood protection, macroinvertebrates, fish, dragonflies and terrestrial ecology. To selected

and apply indicators, their sensitivity, specificity and relevance to the respective measures and goals of each pilot project are considered. While biological parameters, hydromorphology and hydrology are always assessed, terrestrial ecology and ecosystem services are considered where these aspects are relevant to the pilot measure.

Lessons learned and outlook

Rivers need room – room is limited: spatial requirements are a well-known bottleneck for river restoration.

We are learning that the catchment approach provides more options and helps to find meaningful project areas. The bigger picture approach considers the whole river system and promotes water management on effective scales.

Participation and stakeholder involvement is crucial: of course, administrative coordination and streamlining of regulations and goals require a lot of resources.

The integrative planning process will simplify over time when it is better established. In LIFE IRIS we can already see the improvement of interdisciplinary co-operation and communication, as stakeholders and experts are coming together regularly and constructive exchange between different thematic areas is consequently increasing.

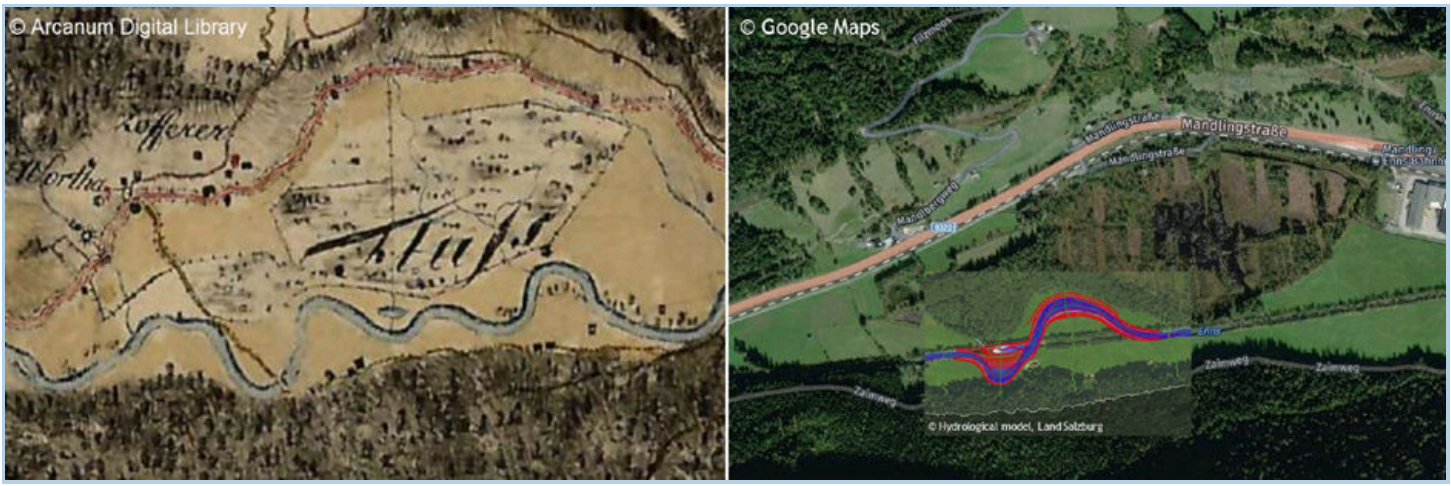

FIGURE 18 *River Enns pilot project encompasses river restoration and flood protection goals.*

Case study: National or regional prioritization of barrier removals in Finland

Saija Koljonen, Finnish Environment Institute SYKE, and Petri Nieminen, South Savonian Centre for Economic Development, Transport and the Environment (ELY Centre), Finland

Restoring at least 25,000 kilometres of free-flowing rivers in Europe to benefit the WFD goals of good ecological status of our waterbodies is a necessary and supported goal within the EU 2030 Biodiversity Strategy. In Finland, this goal has raised questions like how to prioritize, calculate and define the target. Of all the water bodies, about 120,000 kilometres are streams, brooks, and rivers in Finland. In practice, however, the number of small water bodies is much larger, if small catchment basins upstream from the river basins are included. There is a significant number of structures that block and fragment the flow of rivers and streams in Finland; but in general, Finland has good possibilities to restore naturally flowing waters in accordance with the goal. About 2,250 barriers caused by dams have been identified, and in addition to these, the estimated number of blocked road culverts is about 30,000. Fixing the latter to free-flowing ones is usually rather easy to do without causing conflicts with other forms of use, but there is a lot of work to do as the number of blocked road culverts is so high.

With larger barriers there has been several dam removal projects where, for example, an existing small hydropower plant has been shut down and removed. Lately, there have been collaborative discussions about the economic importance of specific hydropower plants, price assessment of their closure and decision-making timeline concerning the cessation (Vesivoimalaskuri (luke.fi)).

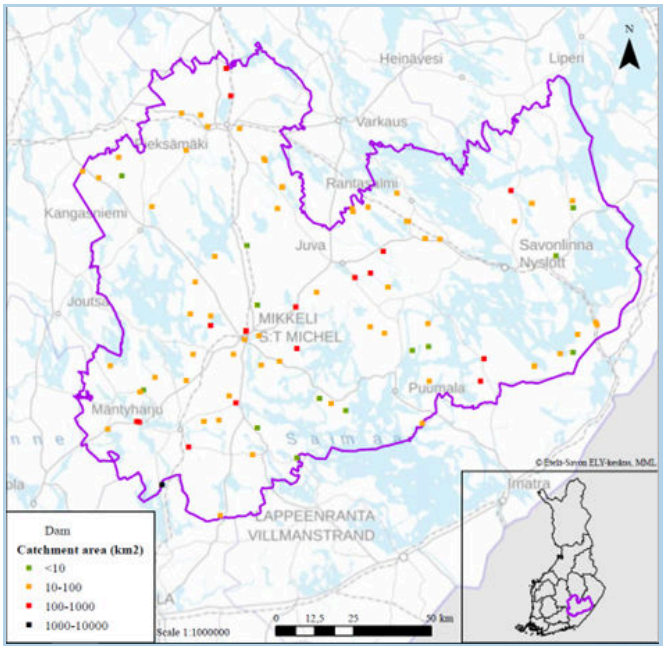

FIGURE 19 *Dams that cause a total migration barrier in the Southern Savonia region classified by the size of their catchment area.*

Nevertheless, ecological prioritization in national level has controversial sights. How strongly should the Finnish state guide the selection of the barriers that should be removed? Is a national prioritization list needed, or should the implementation be made by regional authorities in cooperation with local actors and stakeholders, target by target, when the opportunity arises? If a barrier is prioritized high, does it cost more to redeem?

The state-wide point of view and funding possibilities for the removal of barriers is best known in the national level. There, the ecological prioritization of barriers could lead to a result, where the ecologically most valuable sites are restored first. Prioritization could include the status of the waterbody (ecological status, water quality, pressures) and possibly other aspects like the habitat types and species from the Habitats Directive. However, in the end the practical work is done at the regional level, where there is also the detailed information about the local environment and the ownership of different structures, for instance. Regional Centres for Economic Development, Transport and the Environment (ELY centres) act as a supervisory authority for the Finnish Water Act, which applies to water resources management issues.

Regional perspective

There are about 250 dams in the Southern Savonia area. Of all the dams, about 100 form a total migration barrier for fish and other aquatic organisms, and a third of these are in poor condition or only ruins remain (table 1, fig. 19). There are 13 hydropower plants in the region, and all of these are small power plants with a capacity of less than 10 MW. Of these, only one has a functional fishway at the moment.

Southern Savonia comprises two watersheds, Vuoksi and Kymijoki, and thereafter acts in two different river basin management plans. This region has overall good or even excellent water quality and ecological status in general what it comes to larger lakes. However, in small streams with low water volume, the quality may be somewhat impaired by different activities in the catchment area such as ditching and forestry. Despite of that, there are still potential spawning grounds in the area for brown trout, for instance.

It should be noted that small streams in southern Finland are in general quite modified; only a small percentage of them are in natural state in southern Finland (Development of assessment methods for small streams (arcgis.com)) so restoration efforts are essential for the stream biota.

Barrier removal projects in the area have been either based on local or shareholder initiative

or expert judgement and active measures from the regional supervising authorities. In order to get a project started, it usually needs coordination and/or funding facilitated by the authorities either way.

TABLE 1 *Number of dams in Southern Savonia that cause a total migration barrier sorted by their catchment area.*

Catchment area (km²)	Number of dams
< 10 km²	14
10–100 km²	66
100–1000 km²	18
1000–10 000 km²	1

Most of the barriers caused by dams in the Southern Savonia region are located in small streams with a catchment area smaller than 100 km². Many of the dams are obsolete and have lost their original meaning. By going through old permits and interviewing the owners of the structures, the owners' views on the current condition and future use of the structures have been clarified. Some of the dams are old mill dams, for which permits may date from the late 19th century. Mill and sawmill buildings have often been lost, with dam structures losing their original purpose and no longer being used economically. However, the maintenance of the structures and their use in accordance with the permit conditions are the responsibility of the owner, which incurs costs and labour. Due to their minimal economic importance, they may be removed voluntarily in close cooperation with the owner.

National perspective

On a national level, the case may be different, where ecologically most harmful dams are often linked to large hydropower facilities. In these, dam removal is rarely an option due to their importance for the electricity production. However, in these barriers, mitigation measures such as bypasses with the set environmental flow, are commonly needed.

If a dam removal project is successfully launched concerning an existing hydropower plant, economical compensation is needed to cover the economic losses of the dam owner. This may be the case in smaller hydropower plants, where the best overall solution may actually be to free the river completely. For example, when there is a big investment coming it would be good to help the plant to retire instead of making an investment that might be not economically viable in the long run. In these cases, funding is needed to compensate the loss of the owner, and negotiations are needed to evaluate the price of the plant.

The current government program includes a program for the recovery of migratory fish stocks and the restoration of a continuous natural cycle as part of safeguarding biodiversity. By means of support and measures under the migratory fish programme NOUSU, the government improves the state of migratory fish and other threatened fish populations in several sites in different parts of Finland. Migratory fish projects have inspired different stakeholders to cooperate in different parts of Finland.

EU 2030 Biodiversity strategy in Finland

A collaborative project produced background information to allow Finland to effectively participate in matters such as planning the details and implementing the EU Biodiversity Strategy for 2030, and to make it possible to take the goals of the strategy into account in the planning of the Finnish national biodiversity strategy (Arvio EU:n biodiversiteettistrategian 2030 vaikutuksista Suomessa – Jukuri (luke.fi)). The study examined Finland's starting point with respect to the goals of protection and restoration, while seeking to evaluate what the effects would be if the goals were to be fully implemented. The evaluation of the effects from Finland's point of view is still preliminary, as the goals mainly apply to the entire EU, and have not been allocated to the individual memb-

er states. The goals still need to be more precisely defined to a large extent (Finnish Environment Institute > Study: Finland has some readiness for implementation of EU biodiversity strategy (syke.fi)).

Nevertheless, a national scale prioritization is needed for the dams that cause a migratory barrier in large catchments. Which are the ones to be taken down in the future and how to allocate proper resources and funding for the work? Smaller ones can be taken down voluntarily, by regionally based authorities and organizations with the help of the ongoing migratory fish programme.

In any case, all the dams that cause a migratory barrier should be categorized at least by their catchment size and their potential of freeing streams and rivers behind them. A consistent way to promote these matters needs to be developed.

Conclusion

All in all, the EU is going in the right direction with releasing policy that is ambitious nature-wise. Although there are some more questions that would need to be addressed to effectively place nature-related ambitions, goals and policies into practice, and guide MS in the implementation of river restoration measures, the biggest challenge will remain in balancing the needs of nature and anthropogenic uses of rivers. Therefore, this means balancing policies of different sectors for the successful implementation of restoration projects. However, what is encouraging, as proven by this conference and workshop, is that multiple success stories (with lessons learned) exist, and could guide further restoration work.

Moreover, many positive indications have been given to make the current river restoration approaches that we know more integral. EU water legislation and policies support this and national and local legislation certainly do not hinder this approach, at most they can be better aligned with it. This means that the river basin committees that are responsible for the implementation of the policy have a primary role to play.

To briefly touch upon the discussions revolving during the workshop, further work related to the effective implementation of the river restoration project would demand understanding and defining functional river units and aiming to restore them. Also, some knowledge and innovation – especially focused on nature-based solutions – as well as better availability of funding and improved governance would be needed to improve the EU's rivers.

FIGURE 20 *The view of Lake Annecy.*

Colophon

Contact

✉ secretariat@ecrr.org
P.O. Box 2180
3800 CD Amersfoort
☏ +31651216467

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ECRR Board represented by
Bart Fokkens

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Bart Fokkens, ECRR
Francisco Martinez Capel, CIREF

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