River restoration in Europe: the art of the possible

RESTORE Layman's Report: LIFE09/INF/UK000032

'River restoration is a collective adventure across Europe…Now is the time to move from local and experimental projects to broad scale implementation across Europe's rivers.' European Commissioner for the Environment, Janez Potočnik– Keynote plenary speech, European River Restoration Conference, Vienna 2013

The RESTORE project is made possible with the contribution of the LIFE+ financial instrument of the European Community

and works in partnership with ECRR

The role of RESTORE

Rivers: Engaging, Supporting and Transferring knOwledge on River Restoration (RESTORE)

RESTORE ran between 2010 and 2013. It launched with six European partners and the objective of making connections between river restoration professionals in Europe and joining existing national efforts on river restoration.

Research carried out prior to RESTORE had shown that the main problem faced by river restoration professionals is often not a lack of expertise but a lack of access to shared experiences and knowledge. To address this issue RESTORE worked to share and promote information on the best and most effective means of carrying out river restoration in Europe.

RESTORE received funding from the LIFE+ financial instrument of the European Union.

The Layman's Report

More than a project report, the RESTORE Layman's Report is an agenda setting document highlighting the achievements of RESTORE, while also looking beyond RESTORE and stressing the key policy and technical challenges that still need to be overcome to take river restoration forward. The report will provide a direction for future activities in the hope that these will be taken up by policy makers and river basin managers.

RESTORE objectives

Support river restoration practices across Europe

Build up existing river restoration network capacity

Promote effective river restoration knowledge transfer

Establish long term river restoration knowledge sharing

Key messages

Explain and raise awareness of good practice river restoration in Europe and how it can:

-meet the targets of the Water Framework Directive and the Birds and Habitats Directives

-mitigate the impacts of hydropower in line with the EU Renewable Energy Sources Directive

-contribute to wider economic and environmental benefits and ecosystem goods and services

-explain and raise awareness of how river restoration can mitigate against the effects of climate change on river habitats

River restoration: the art of the possible

Human society and development have dramatically changed the way land is used. Rivers have been straightened and culverted to provide flood protection and to make maximum use of land for housing, industry, infrastructure and agriculture. These changes have often created problems related to flood management, drainage, waste and a lack of good recreational space.

But it is possible to halt the damage being done to the water environment and bring rivers back to life. River restoration is the art of the possible. It can act as a catalyst to transform cities, towns and rural landscapes into truly living environments, helping to re-establish connections between rivers and communities and helping people see the benefits rivers provide.

With vision and skill degraded rivers can be transformed from polluted, lifeless, concrete channels into vibrant ecosystems providing people and the environment with water, food, wildlife, energy, transport, recreational space, riparian forests, natural floodplains, purification systems and even ways of combating climate change.

The activities of RESTORE have helped share this approach to river restoration. The project aimed to bring people together by establishing networks through its website, events and conferences, to give professionals the information they need to restore rivers and in doing so achieve a variety of environmental, economic and social objectives.

RESTORE's legacy can continue to deliver knowledge and broaden networks in order to increase the practice and implementation of river restoration in Europe.

What is river restoration?

Rivers are the life-blood of the European landscape but they need protection and restoration. Restoring natural conditions improves the resilience of riverine systems and enables rivers and estuaries to have sustainable and multifunctional uses.

River restoration is a loosely defined concept but it is a multi-disciplinary approach and refers to a variety of ecological, physical, spatial, and management measures and practices. These are aimed at restoring a more natural state and functioning of the river system in support of biodiversity, recreation, flood management and landscape development.

River restoration offers multiple environmental, social and economic benefits. By improving habitat and water quality river restoration can create a more attractive landscape which in turn can create opportunities for social and economic improvements such as enhanced recreational resources, improved quality of life and, evidence suggests, increased property values.

River restoration is not about returning rivers to a pristine state (if we even knew what that was), it is about making rivers which are good for people as well as the environment, which sit within our current systems and society, but also have a functioning ecosystem.

RESTORE's achievements

RESTORE developed a website, produced a monthly bulletin and set up a RiverWiki which is an interactive *Wiki*-style database of case-studies. The RESTORE partnership took part in

and hosted over 30 seminars and conferences, including a final conference in Vienna, Austria in 2013. RESTORE also contributed dozens of articles to magazines and bulletins and wrote *Rivers by Design*, a guide about river restoration for the planning and development sector.

RESTORE has ensured continuity through cooperation with the European Centre for River Restoration (ECRR). The ECRR is a European network consisting of national centres and individual members bound by their mission to enhance and promote river restoration throughout Europe. From January 2014 ECRR will host the RESTORE website and the RiverWiki will be managed by the River Restoration Centre (RRC) on behalf of the ECRR. The RRC, located in the UK, is a national advisory service on all aspects of river and floodplain restoration.

In this way the RiverWiki and the website will be maintained.

RESTORE website www.restorerivers.eu

The RESTORE website is a knowledge sharing tool and essential resource for anyone interested in river restoration policy and practice in Europe.

The website features key themes with concise overviews of the most important European river restoration issues, links to case studies and additional resources. It has step by step guidance on how to do river restoration, a RiverWiki, presentations, publications, news, and the results and conclusions from all RESTORE events.

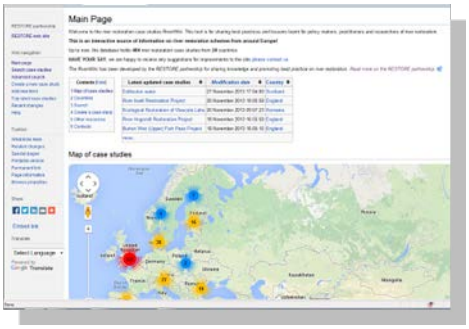
RiverWiki

http://riverwiki.restorerivers.eu

The RiverWiki is a key achievement of RESTORE. It is an interactive database of over 500 case studies from across Europe with examples of restoration, mitigation, enhancement and rehabilitation which illustrate the multiple benefits that can be achieved through properly planned and executed projects.

The RiverWiki was developed to facilitate a pan-European network of information linking policy makers, practitioners and other stakeholders. By using the RiverWiki these groups can develop the tools and skills to restore rivers and share, find and comment on river restoration projects.

Registered users are able to upload case studies. With its interactive social media element projects can easily be shared and rated and as such it is transparent public record of European river restoration, offering a valuable resource of research and evidence.



Screenshot of RiverWiki main page

The RiverWiki will continue to grow after RESTORE. As more case studies are uploaded and the information is refined it will become an increasingly valuable tool. RESTORE's aim is for the RiverWiki to become the principal repository of river restoration case studies in Europe and it is already playing a vital role in that respect.

Rivers by Design: a guide for the planning and development sector

Rivers by Design was written for professionals in the development and spatial planning sectors without specific knowledge of restoring rivers. The guide offers practical advice and step-by-step help on restoring rivers. It contains a series of case studies illustrating how working with riverine processes and integrating rivers into developments can be beneficial from economic, social and environmental perspectives.

5th European River Restoration Conference, Vienna 2013

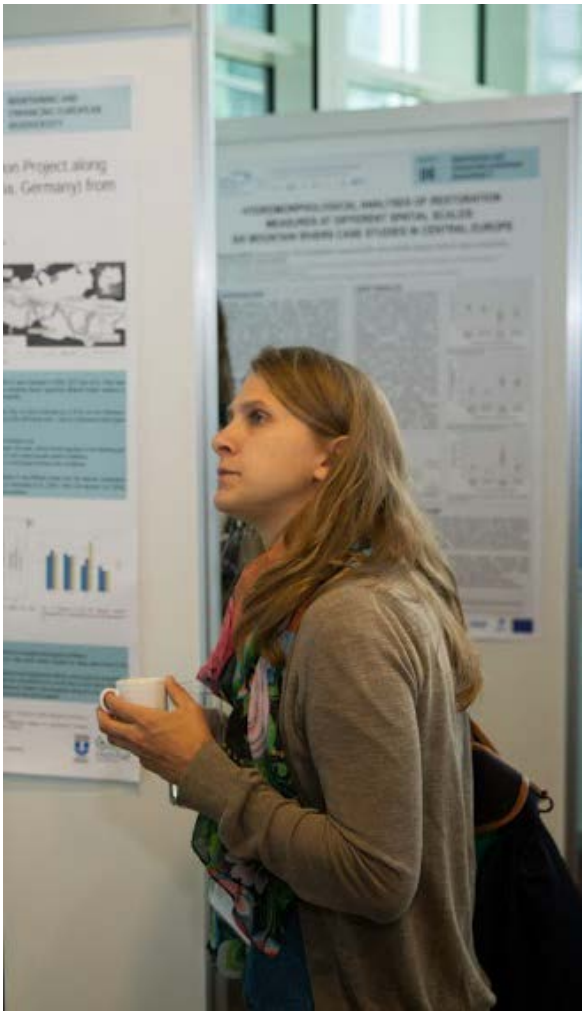
http://www.restorerivers.eu/errc2013

RESTORE's final conference brought together over 300 participants from 35 nations. The event enabled restoration professionals to contribute their experiences, share their knowledge and make connections in order to advance the science, policy and practice of European river restoration.

The programme included more than 100 presentations and covered 15 themes. The event also celebrated the first ever European RiverPrize, awarded by the International River Foundation.

The conference fostered a participatory approach and a stronger role for practitioners and organisations involved in delivering restoration. Seminars and networking events enabled participants to share knowledge and best practices and to learn about tools such as the RiverWiki and the RESTORE website.

The conference was recorded on film, photographs, tweets, emails and news items. All this material, including presentations and posters and a video of each session and keynote speech is archived on the RESTORE website. These materials are a substantial repository of information that will continue to draw viewers to the site and extend the reach of the conference far beyond its participants.



Poster presentation during Vienna conference

Themes

Across member states in Europe there are a number of different challenges and opportunities for river restoration. RESTORE brings together several of these key themes on its website with the best available

knowledge, case studies and links to additional resources.

This section briefly examines the key issues and needs of river restoration and the tools RESTORE has provided to answer those needs. RESTORE has looked at what has been achieved so far and what remains to be done in terms of policy and technical challenges to take river restoration forward.

How to do river restoration runs as a guiding approach throughout all of the website themes and it is also given its own website section (outlined below).

How to do river restoration

River restoration stands at the threshold of a change in thinking where rivers are not seen as a problem to be solved, or simply as a supply of water. Rivers are being recognised as living systems where river restoration supports and enhances biodiversity, water quality and flood management, and also provides economic and social benefits for people and industry.

The impact of RESTORE

The RESTORE web pages *How to do river restoration* provide RESTORE's over-arching approach to river restoration and offers step by step guidance on planning, designing, constructing and monitoring a restoration project. This is the most frequently visited section of our website which indicates the need amongst practitioners for reliable and easily accessible information on working with natural riverine processes.

Within this theme RESTORE has provided practitioners with training and further resources to increase their knowledge and capacity to plan, execute and manage successful river restoration projects.

For instance, RESTORE held a two-day technical course in Utrecht, Netherlands, for 30 practitioners focusing on the importance of understanding natural river processes when designing river restoration projects for ecological and habitat benefits.

An event held in Scotland for 70 practitioners discussed the impact that barriers have on sediment, flow and fish in high energy river systems, and the benefits of implementing natural fish passage.

RESTORE also held events in regions where river restoration projects are less common and where policymakers and the public have little knowledge about it. For instance, a workshop was held in Ruse, Bulgaria in 2012 for policy makers and river basin planners about integrating river restoration into infrastructure such as flood protection and hydropower plants.

The benefits of events such as these include providing up to date information, learning about the difficulties faced by practitioners, and identifying new practices and ways of informing policy makers and other stakeholders. Developing restoration assessment tools to support cost effective restoration has also been discussed at these events.

Key findings

Over the past three years the feedback from RESTORE's conferences and workshops has indicated an increasing understanding that large scale river restoration projects are needed and restoration at the larger catchment scale is required to realise the greatest benefits of an ecosystems approach. Therefore practitioners need additional guidance on a corresponding scale.

Communicating what river restoration is for and what it can achieve is important and communication tools need to be improved to reach a larger more varied audience.

Expanding the vision and scale of river restoration requires asking communities how their rivers should be managed and restored. This requires more evidence on the multi-functional nature and the economic and social value of rivers in order to provide convincing arguments.

Increasing the scale of river restoration also requires improving partnerships and better explaining successes and opportunities with the interests of particular audiences in mind. This includes recognising and learning from failures.

Designing a project is not the end of the river restoration process. Once the restoration team leaves the site the river will continue to evolve. Often the benefits will take decades to come to fruition and effective monitoring is needed to assess success and inform adaptive management.

Theme: Flood risk management

River restoration contributes to more sustainable flood risk management by increasing the capacity of rivers and floodplains for water retention, thereby reducing flood risk. River restoration reduces the likelihood of high peak flows and improves the natural functions of the river at the same time.

Responding to flooding by putting rivers in concrete channels to take water away as fast as possible, and building ever higher and more expensive walls to protect homes and businesses, makes neither good environmental or economic sense. This simply pushes the problem downstream, increases the risk of flooding and involves expensive maintenance regimes.

Instead of continuing to tamper with the way rivers work, it can be cheaper and more sustainable to work with natural riverine systems which create additional benefits at the same time.

The impact of RESTORE

A substantial body of case studies relating to flood risk management is now held on RESTORE's RiverWiki including the Harbertonford Flood Alleviation Scheme (UK), and the Rio San Martin and Piovega di Scandolara restoration project in the Lagoon of Venice catchment (Italy).

RESTORE held several events on this topic including two workshops in 2012: in Lille, France to discuss the restoration of Europe's rivers in the context of wider water management objectives and in Aarhus, Denmark to collect information on the perceived limits facing practitioners implementing floodplain restoration in Europe.

RESTORE's successes in knowledge-sharing on this topic were reinforced by its final conference in Austria, 2013. Flood management ran as a theme throughout the conference and was tackled directly in Session 3: Sustainable Flood Risk Management.

Key findings

River restoration is increasingly being delivered by creating space for flood water, but to do this effectively work needs to be done at the catchment level and the larger basin scale linking it to the Floods Directive and spatial planning legislation. This requires more evidence and case studies exploring options at different restoration scales, and

there is still work to do on changing attitudes and influencing future policy making.

RESTORE's case studies, conference findings and feedback show flood risk management can offer multiple benefits and river restoration should be considered as a priority while balancing competing economic, social and environmental interests.

Reconnecting floodplains to the river, and managed realignment in estuaries increases flood capacity in a sustainable way. However, this change in approach is dependent on convincing people, industries, agriculture and businesses that moving from controlling floods to managing the risk is necessary. This is a long term approach requiring the engagement, direction, input and consent of these sectors.

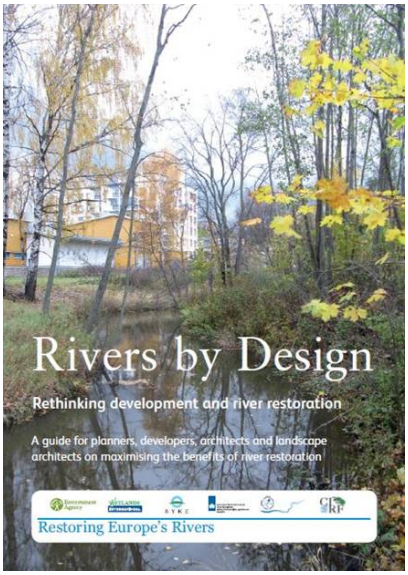
Theme: Spatial planning

Spatial planning in both urban and rural areas is the fundamental tool for delivering river restoration in Europe. It enables planning authorities to incorporate river restoration in developments by reflecting objectives such as the WFD, the Common Agricultural Policy (CAP) the green infrastructure approach in planning policy and delivering these through planning decisions. This can generate multi-functional benefits such as reduced pollution, improved flood prevention, increased recreational facilities, reduced heat stress and increased value of waterfront housing.

The impact of RESTORE

Given the importance of spatial planning to delivering restoration RESTORE targeted the planning, policy and development sectors. RESTORE's guide *Rivers by Design* offers practical advice, step-by-step guidance and case studies to support the development sector, enabling them to incorporate river restoration in their projects.

RESTORE held three sector events, including two highly successful events in London: a Thames boat trip to target managers and directors in the planning sector, and a 'breakfast talk' showcasing river restoration projects in London aimed at professionals in the development sector.



Key findings

There is a long way to go to integrate river restoration thinking in complementary sectors such as planning and architecture. Although many development professionals have worked with schemes involving rivers, and the issue of flooding has been highly visible and publicised in the past ten years, the lack of knowledge about the need for restoration is significant.

The need to communicate with people was a key finding across all themes, but especially so within spatial planning. There is clearly scope for more focused knowledge aimed at this sector such as case studies

showing river restoration being delivered through the planning system.

More clearly defined links and ways of reaching spatial planning organisations to share information are needed, as well as discussing policy needs and implementation at all government levels. At the local level more innovative avenues of communication and tools to engage local planners, the development sector and the public could lead to greater cross-sector cooperation.

Theme: Economics

When is it worth restoring a river? This is the bottom line of any project since it will determine what can be achieved given the resources available and whether restoration is worthwhile from an economic perspective. But monetary efficiency is only one factor in estimating costs for a project. Other factors such as social justice and equity must also be evaluated, particularly in publicly funded restoration projects.

The impact of RESTORE

The RESTORE website provides practitioners with research-based tools and methodologies for costing and offers links to more detailed analyses on these approaches. Various methodologies are presented in the RESTORE publications database and actual costings of different types of restoration schemes can be found in the RiverWiki case studies

RESTORE presented events and workshops such as Benefits and costs of river restoration held in Spain in 2011, as well as the final conference: Session 2: Cost effective solutions to river management

Key findings

There is a need to develop the economic and political case for river restoration with more evidence on costs and benefits. Currently river restoration is often seen as a 'nice to do' rather than a valuable approach in its own right or as a requirement of many directives. This view is also likely to be influenced by a lack of easily accessible information about the cost of delivering and maintaining a river restoration project.

Practical and effective incentive approaches to restoration are needed as well as ways of accessing and joining up financing schemes. Practitioners also lack knowledge about ways of accessing funding.

Many costing models are not inter-calibrated between countries. Linked to this is the need to establish common goals in cross-border work since a lot of restoration is about building trust to produce cost-effective solutions. Priority should be given to cost-effective river restoration which relies on natural processes and needs less maintenance.

Some countries offer stronger drivers and incentives for river restoration than others which is often linked to funding and current policies and practice. Economic evidence is therefore a powerful tool within the development sector and simple tools for non-professionals to estimate the costs and benefits of river restoration, linked to ecosystem services, are urgently required.

The case studies on the RiverWiki offer some information but there is clearly a need for modelling tools to compare alternative restoration strategies and to assess the value of all ecosystem services associated with

rivers such as its value as a clean water supply and its recreational value. This needs to be linked to creating better communications tools to make effective use of such economic analyses.

Theme: Hydropower

Dams, weirs and abstraction of water for power generation constitute a serious threat to functioning river systems. They alter the flow of water and sediments and reduce the degree to which rivers are connected across a landscape. They block migratory pathways and reduce access to spawning habitats.

The public view of hydropower though is generally positive since it offers clean renewable energy. However, hydropower production is a key reason for designating a river as a heavily modified water body, and this threat is increasing as the EU seeks to achieve its renewable energy targets.

Increasing demand for energy in Europe and the need to increase the supply of clean renewable energy is therefore in conflict with our efforts to decrease the impact of hydropower plants and to stop the further deterioration of waterbodies. It is therefore a high priority to reduce the impact of existing hydropower plants, to evaluate the sustainability of new ones, and to achieve a high level of mitigation and compensation to meet Water Framework Directive (WFD) targets.

There are powerful financial tools in some countries to support mitigation schemes. For instance in Switzerland, through the new Federal legislation on water protection, a share of the price of electricity produced by hydropower (0.1 CHF cents per kWh) is directed to a fund for mitigation measures (50 Million CHF per year). These are mainly related to mitigating the effects of hydropeaking; other measures such as fish passes or restoration of sediment continuity are also eligible.

The impact of RESTORE

RESTORE addressed hydropower with local governments, power companies and restoration practitioners through its events and conferences. RESTORE's Finnish partner, SYKE, has been particularly successful in this area and is now the leading organisation tackling these issues in the Nordic region where a large proportion of hydro-power plants are located.

Photos showing before and after removal of Goshan Weir, River Roch (UK)

Before removal of weir: photo courtesy of Oliver Southgate, Environment Agency (UK)

After removal of weir: photo courtesy of Oliver Southgate, Environment Agency (UK)

SYKE, and RESTORE partners CIRF (the Italian River Restoration Centre) and RRC (River Restoration Centre) held events which were models of collaboration. They were

particularly successful in gathering and sharing information about hydro-power and its mitigation measures in Switzerland, Germany, Sweden, Norway, and Finland.

The RiverWiki holds several excellent hydropower case studies including the Ruppoldingen and Rheinfelden case studies in Switzerland and Germany, which mitigated the impacts of a hydropower plant, allowing free fish migration and also provided important habitat compensation.

Key findings

RESTORE found a good level of knowledge about key pressure factors and also qualitative information on river quality in relation to hydropower. For instance there is significant evidence that small hydropower plants do not necessarily have less impact than larger plants and there is plenty of detailed technical guidance available on mitigation methods with specific examples (e.g. fish passes).

However, RESTORE also found a lack of detailed scientific knowledge on a few specific factors such as hydopeaking (rapidly switching between a low base and a high peak flow for power production in periods of high energy demand); and because of this it is still difficult to define good mitigation measures.

There is a need for a strategic assessment of actual and planned hydropower plants and their impacts. At present applications are generally determined on an individual basis and the cumulative effects of projects in the same catchment are not assessed. In line with WFD a more holistic approach to assess cumulative impacts is needed. This lack of information is particularly acute in the Alpine regions where hydroelectricity is the leading source of power and is having a serious affect on the ecological health of Alpine rivers.

Additional knowledge and evidence is also critical to develop better regulations and policy in the following areas: better indicators to improve ecological status for WFD, environmental flow (particularly in relation to larger catchment areas), the impacts of morphology and sediment transport, and the efficiency of compensative habitats and fish passes.

Feedback from RESTORE's events also indicated that monitoring and evaluation are needed over longer time frames and should be used to set realistic goals and develop success stories from good results. Evaluation of hydropower needs to include economic as well as environmental benefits and trade-offs linked to maintaining ecosystem services. This could be useful in improving levels of public participation in planning new plants.

Theme: Habitats, Fisheries and Agriculture

River restoration is a powerful tool for maintaining and improving conditions for wildlife and connecting habitats. The objective of improving the environment is supported by directives such as the WFD and Natura 2000, and approaches such as green infrastructure. However, designated protected areas have focused on terrestrial sites and neglected sites with importance for aquatic biodiversity. The return of endangered migrative fish stocks into European rivers is a success, but many stocks remain impoverished and still need river restoration for improved habitats.

In Europe 95% of floodplains have been damaged by urban development or intensive agriculture, resulting in fragmented habitats. It is generally accepted that restoring these fragmented aquatic habitats is key to achieving successful restoration, either by removing barriers or by linking river corridors to floodplains, wetlands and saltmarshes. Consequently river management is changing and practitioners are increasingly looking at the river basin rather than simply the river itself to achieve the maximum benefits of restoration. As a result restoration practitioners need to address wider land-use issues affecting urban, rural and agricultural sectors and communities.

Ruppoldingen power plant (Switzerland), showing measures for fish passage and habitats: photo courtesy of Jukka Jormola, SYKE

The impact of RESTORE

RESTORE's RiverWiki is helping practitioners build up evidence of the successes and failures of common approaches to restoration. RESTORE has also achieved significant impact through its conferences, field trips and seminars by sharing knowledge and taking discussions forward by offering practitioners a platform for discussion.

For instance at an event in Sweden SYKE explored the issue of agriculture and hydropower, in Brussels the RRC looked at the benefits of restoring natural processes, and in Italy CIRF held a conference on river restoration within river basin management plans.

Key findings

Flexible restoration practices which take account of local variation need to be developed. Better partnerships and new ways of negotiating between competing interests are needed.

Climate change may affect biodiversity by increasing the frequency of extreme weather events, reducing flows and warming rivers. River restoration needs to be implemented to help reduce these pressures and allow biodiversity time to adapt to these changes.

There is a need to identify the environmental flows necessary to help recover fish populations and aquatic biodiversity. This would allow local decisions to be made recognising the whole catchment needs. In many areas through, current agricultural, industrial and domestic pressure reduced river/ instream flows impact on aquatic health.

There are many examples of habitat restoration at the local scale. However, pressure factors and degradation trends are frequently caused by large scale dynamics. Additionally many countries still consider their freshwater and estuarine systems separately. Therefore better integration of large scale

processes is needed to protect and restore habitats such as Natura 2000 sites.

Theme: Policy – Meeting EU directives

River restoration directly supports the aims of several important water-related policies in Europe. In particular, large-scale river restoration offers opportunities to promote healthier, more resilient river ecosystems; while at the same time meeting multiple environmental and social policy objectives such as the WFD, Floods Directive, Natura 2000 and EU 2020 Biodiversity Plan.

Despite this legislative framework, physical modifications of rivers and diffuse pollution are currently leading to massive failure in the good ecological status of Europe's waters as concluded in 'European waters - assessment of status and pressures', published in 2012 by European Environment Agency.

The WFD is challenging but sound in its conception. More integration of directives such as CAP, WFD, floods directives and renewable energy directives is needed so that measures are linked and work together. Integrated catchment, river basin management and the restoration of ecosystems at larger scales are needed to address these multiple drivers and to provide multiple benefits.

River restoration has historically centred on small-scale, single site restoration. However, recent EU policy guidance such as the *Blueprint to Safeguard Europe's Waters* and a communication on Green Infrastructure recognises the need to make greater use of saltmarsh, wetlands and other natural and semi-natural areas across Europe to support cleaner waters and reduce flood risk.

The impact of RESTORE

Through its workshops and conferences RESTORE has raised awareness and enhanced knowledge on the connections between practice and policy, and the challenges of mainstreaming river restoration into policy. For instance:

Brussels Policy Workshop – Discussing the challenges of river restoration in June 2013.

Several RESTORE partners contributed to a submission on the European Commission's Consultation on Policy Options for the Blueprint to Safeguard Europe's waters.

RESTORE's final conference brought together policy and practice and included participation of the EU Environment Commissioner and Water Director. It showcased the latest thinking from leading policy makers and professionals about integrating river restoration into European policy and practice.

Cartoon produced by Christian Ridder for Vienna Conference 2013

Key findings

As the approach to water management changes to one based on making room for rivers and considering whole catchments,

there is a corresponding need for a stronger supporting knowledge base, manuals, and more ways to share this experience and information. This includes transnational cooperation and working with NGO's to help deliver policy on a larger scale.

Guidance to successfully implement policy, such as CAP and green infrastructure on the ground is needed.

River restoration needs to move from the local to the basin scale. However, while planning at the large scale there is a need to engage at a local level and tools such as voluntary river contracts are valuable for collaborative local engagement.
Prior directives have led to major progress in tackling the biggest sources of pollution. However, more effective use of existing policy is needed to tackle longer term problems such as the physical form of rivers (morphology), sediment and diffuse pollution.

A regulatory role in water management is important but there is not a clear regulatory solution in many countries to the many water pressures of diffuse pollution and changes to the structures of rivers. Businesses must be persuaded to innovate. Advising operators to make appropriate improvements in advance is more cost effective than prosecutions and avoids damaging pollution.

Businesses are potential WFD catchment stakeholders. Government frameworks need to be developed to support business engagement and to develop innovative partnerships.

Understanding the barriers to implementing policy should be a priority. Policies commonly fail due to competing objectives, and local authorities are also still approving initiatives that degrade the environment.

Better use and development of available resources would be beneficial, for instance by developing the evidence base and incorporating Payments for Ecosystem Services into mainstream funding. Payment for ecosystem services also has the potential to help the public, stakeholders and decision makers to better value an improved environment, which in turn can influence better decision-making.

River Fletching (UK): photo courtesy of Dr P. Karageorgopoulos, Environment Agency (UK)

Way forward

Practitioners and policymakers have embraced RESTORE's networking initiatives, conferences and events in the past three years. If the benefits of cross-border partnerships and knowledge-sharing are to be maintained and developed then future initiatives to increase the level of awareness about river restoration and to integrate it into European, national and local policy are required.

The following recommendations are based on RESTORE's findings:

- Scale: where appropriate there is a need to move from small scale projects to larger river basin scale approaches that restore ecosystem functions.
- River restoration must be incorporated into all development and policy-making through green infrastructure, an integrated approach and knowledge-sharing.
- Benefits: river restoration must offer multiple environmental, economic and social benefits, with realistic targets reflecting the needs of communities
- Policy-making should reflect the importance of other sectors such as planning, development, agriculture and industry in meeting good ecological status for Europe's waters.
- Engage local communities: implement with, and at, the pace of stakeholder interests and capacities to yield sustainable results
- Capacity & knowledge: encourage more networking, sharing best practice and developing knowledge for key groups including policy makers, river basin planners, architects, planners.
- More scientific based information is needed on: the quality and quantity of water flows, river basin characteristics and the economic basis/costs of river restoration.
- Monitoring: this should be a requirement through policy. Gathering evidence, centred on scientific data, from a variety of projects will improve understanding about the effects that different restoration measures have on rivers and catchments.

Maintaining RESTORE's achievements

Maintaining and building upon the achievements of river restoration practice will prove challenging.

Working across sectors will be vital. The communication networks RESTORE has established and built upon are an important tool in achieving this for practitioners, planners and river managers. Networks such as the ECRR and LIFE+ projects, together with the RiverWiki, will be vital in maintaining the growth in knowledge and practice in river restoration and water management.

These networks and tools help to bridge the gap between science practice and policy. Moreover there is an ongoing need for sharing practical knowledge and experience. In particular information on newer green infrastructure techniques needs to be shared.

A key finding of RESTORE is that river restoration needs to move towards large scale implementation. This makes it an ideal candidate for the forthcoming LIFE

Integrated Projects scheme which will focus on larger and more strategic projects tackling environmental challenges related to the Birds and Habitats Directive, and WFD.

The networks RESTORE established, which have improved the practice of river restoration and increased understanding about integrating river restoration into national and European policy, are critical to developing and sharing knowledge. It is therefore vital to continue supporting the ECRR in maintaining RESTORE's achievements.

Glossary

A list of technical terms relating to river restoration can be found on the RiverWiki dictionary: http://riverwiki.restorerivers.eu/wiki/index.php?title=Help%3ADictionary

About RESTORE

RESTORE ran between 2010 and 2013 in partnership between Environment Agency, Wetlands International, Government Service for Land and Water Management (DLG - Netherlands), Finnish Environment Institute (SYKE), Italian Centre for River Restoration (CIRF) and DEFRA.

RESTORE received funding from the LIFE+ financial instrument of the European Union.

From January 2014 the European Centre for River Restoration (ECRR) will host the RESTORE website and the RiverWiki will be managed by the River Restoration Centre (RRC) on behalf of ECRR.

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