Restoring Europe's Rivers

# B3: Review of EU policy Drivers for River Restoration

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**RESTORE - Rivers Engaging, Supporting and Transferring knOwledge for Restoration in Europe**

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# Executive Summary

## RESTORE

RESTORE (Rivers: Engaging, Supporting and Transferring knOwledge on River Restoration) is a LIFE+ funded project aimed at supporting existing and future river and floodplain restoration activities across Europe. The RESTORE project aims to develop the tools and skills to enable the restoration of rivers for future generations creating sustainable river environments. The project will develop an understanding of why river restoration needs to happen and any barriers to it.

The RESTORE project was developed due to the large numbers of water bodies that are currently failing to achieve good ecological status due to hydromorphology. The work will share information and best practice on river restoration activities to aid Water Framework Directive delivery and will run for three years until September 2013.

## What is this report about?

This report forms Action B3, part of the RESTORE project's communication activities. The purpose is to share knowledge and experience that will be of value to all partners and stakeholders and to inform future policy debate.

This report sets out the key drivers and EU legislation and policies that have led to a need to call upon the toolkit for more complex and integrated forms of floodplain and catchment river restoration. It specifically identifies the most significant barriers and constraints that need to be overcome in EU Member States. Examples of good practice are also referenced to facilitate an exchange of information between stakeholders within and across different Member States.

The report provides a high level review of barriers, constraints and opportunities. Whilst taking a pan-European view using available English summaries in publications and by posing questions to select stakeholders across Europe, this review is limited to the generic findings and is biased towards examples from the UK. Anyone with comments or additions to make (including significant case studies in Member States) is invited to contact the Project Manager:

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## Principles

Traditional drivers of river restoration arise from European and National legislation and policy relating to nature conservation; fisheries management; flooding and flood risk management; landscape and projects by private developers and individuals. The majority of river restoration projects undertaken to date have generally involved non-complex land ownership issues and are restricted in the main to single sites. Generally theses are projects primarily driven by a single piece of legislation or policy.

More recently policy shifts have occurred, requiring more holistic and integrated larger-scale restoration. Drivers include floods in Europe over the past decade leading to a view to the use of floodplains for natural storage; improvement to water quality and morphological status; and improved and more extensive agri-environment schemes.

## The challenge

Despite efforts over the past decade or so (in response to environmental directives) there has been a continued deterioration of valuable habitats (European Commission, 2011). This is not necessarily due to how this legislation is implemented in Member States; rather it is a reflection of the difficulties of overcoming one or more of the barriers to implementation. Although there are ongoing calls for policy shift, the premise of this report is that there are institutional structures and learning lessons which can perhaps be transferred from one Member State to another.

## Key legislation and policy

A range of European Commission Directives or National legislation and policies have led to an actual demand for river restoration tools and techniques. The Directives and policies can generally be grouped into two categories:

1. Those which *drive* the delivery or river and catchment restoration, because restoration offers a means of meeting the objective of the Directive or policy, and
2. Those which *support* the delivery of river restoration, through wider environmental improvements, such as water quality, without which a restoration project might fail. In these instances, river and catchment restoration does not necessarily deliver the objectives of the Directive or Policy.

Legislative drivers of river restoration include:

- Habitats and Birds Directives
- Water Framework Directive
- Floods Directive
- UN Biodiversity Plan
- EU 2020 Biodiversity Plan
- Rural Development Programmes
- Climate Change Adaptation Policy
- Land Use Planning Policies

Legislation which supports the delivery of restoration includes:

- Common Agricultural Policy
- Nitrates Directive
- Groundwater Directive
- Soils Framework Directive

## Key barriers, constraints and opportunities

Numerous barriers and constraints have been identified, including:

- Inflexibility of existing legislation and policy
- The need for a closer alignment of multiple policies
- The requirement to purchase of land outright or change in use of land
- Limits on funding in the current economic climate
- Complex institutional and administrative boundaries
- Issues with land use planning and land use planners
- Multiple and competing floodplain uses
- Agriculture land use requirements and practices

- Water quality, especially high silt loads
- The promotion of hydropower schemes which require weirs or dams
- Lack of public and political understanding or acceptance of river restoration
- Complex restoration projects requiring multiple consenting regimes
- Lack of a scientific evidence and monitoring to demonstrate the value of restoration
- The need for stakeholder involvement to address social issues

A number of good practice examples of projects which have overcome barriers and constraints are emerging. The report provides examples of the types of opportunities for river restoration which may have wider applicability across Europe:

- Demonstrations of combining legislative and policy drivers
- The use of land banks and land exchange mechanisms (e.g. Netherlands and Denmark)
- Raising funds through improved benefits and costs evidence and the use of concepts such as Ecosystems Services
- The Dutch Water Test (Watertoets)
- More integrated spatial planning – Room for the River Programme (Netherlands)
- Catchment Coordinators to address diffuse pollution issues (e.g. in Scotland)
- Stakeholder partnerships (including Rivers Trusts in the UK)
- Other emerging opportunities focused on a catchment approach

Many barriers can be overcome through effective participation of stakeholders and by adopting effective approaches to implementation. In general, project management and coordination skills of individuals are central to the successful delivery of restoration. There are some residual constraints, including the need to build capacity of individuals and organisations as the demand for projects increases at a rapid rate.

To illustrate the potential that currently exists to deliver catchment wide river and floodplain restoration a selection of case studies are provided which are either in the planning stages or have been built. These demonstrate a variety of ways in which barriers have been partially or completely overcome and illustrate Europe's ability to 'think bigger':

- Mayesbrook Climate Change Park (UK)
- Reconnection of a floodplain and river (Belgium)
- Extensive planting of floodplain forest (Germany)
- Challenges in agricultural landscapes (Denmark)
- Reconnection of main channel to floodplain (Austria)
- The Houting project (Denmark)
- HEALFISH (Estonia and Finland)
- La Basse project (France)

**Conclusion**

Whatever policy shifts emerge in the future it is likely that holistic, integrated large-scale projects will remain difficult to implement. However there is cause for optimism, particularly if good practice examples are made available to learn from to other Member States (e.g. through the EU LIFE programme).

# Contents

# 1 Introduction

## 1.1 Background to Project

RESTORE (Rivers: Engaging, Supporting and Transferring knOwledge on River Restoration) is a EU LIFE+ funded project aimed at supporting existing and future river and floodplain restoration activities across Europe. The project aims to develop the tools and skills to enable the restoration of rivers for future generations creating sustainable river environments. The project will develop a network linking policy makers, river basin planners and a wide range of practitioners and experts across Europe. The project was developed due to the large numbers of water bodies that are currently failing to achieve good ecological status due to hydromorphology. The work will share information and best practice on river restoration activities to aid Water Framework Directive delivery and will run for three years until September 2013.

It is a joint project between the Environment Agency, Department for the Environment, Food and Rural Affairs (DEFRA – UK), River Restoration Centre (RRC – UK), Wetlands International (WI – Netherlands), Government Service for Land and Water Management (DLG – Netherlands), Finnish Environment Institute (SYKE) and Italian Centre for River Restoration (CIRF). The European Centre for River Restoration (ECRR) will also provide support as an Advisory Board.

## 1.2 Purpose of Report

This report forms Action B3 of the RESTORE project which is to deliver a document that identifies the policy opportunities, barriers and constraints to aid delivery of river restoration. This will assist the delivery of the RESTORE project's communications activities. The document is intended to cover the common themes that affect the European countries covered by the RESTORE project. The purpose is to share knowledge and experience that will be of value to all partners and stakeholders and to inform future policy debate.

The review has 3 key parts:

Part 1 (Section 2) presents the main drivers for policy and policy shift relevant to river restoration in Europe. Policy may be directly relevant to restoration (e.g. Water Framework Directive, Habitats and Birds Directives, Floods Directive) or indirect (e.g. agriculture).

Part 2 (Section 3) identifies barriers and constraints that need to be overcome to enable river restoration as well as highlighting opportunities.

Part 3 (Section 4) provides a selection of projects that have been or are undergoing implementation in the UK and other Member States. These projects illustrate particular barriers, constraints or opportunities.

The policy outcomes listed in this report are not exhaustive (as this is a high level review), but are a snapshot of key actions as well as upcoming initiatives. This report does not form part of a review of policy effectiveness.

## 1.3 Definition of Restoration

Broadly this report analyses policy drivers relevant specifically to large scale multi-objective river and floodplain projects which can be described variously as of a more holistic, comprehensive or integrated kind. That is, projects involving re-naturalisation of physical processes. To date, these have not been easy to implement.

The most common type of river restoration in Europe (that is, for more than 30 years) is site specific (see Brookes and Shields, 1996). Early projects were often single-issue projects (e.g. for fisheries or landscape improvement) of relatively small scale and site-based and this still remains the case. Often these projects involve only one landowner (sometimes with an incentive or willingness to cooperate). Up until the late1990's, these projects generally involved a single policy driver and a single source of funding. Also, river restoration plans including Biodiversity Action Plans have in the past tended to look separately at (rather than link) the freshwater and estuarine parts of a river.

These types of project continue to be planned and implemented and arguably such site-specific works are making a considerable contribution to the first cycle of the Water Framework Directive. However, deferring measures on the basis of inadequate evidence and uncertainty (e.g. in the absence of monitoring results) to future River Basin Management Plans could have unforeseen consequences.

Removing or bypassing one obstruction (e.g. using a fish pass) at a site can have a beneficial multi-reach or catchment impact for fisheries. Some of these projects have involved limited floodplain restoration. Generally they have not however placed the project in a multiple-reach or catchment-wide context with the result that the restoration may not be sustainable. There are a number of additional issues which contribute to successful restoration, primarily water quality issues, including reduced diffuse pollution from an upstream catchment.

For the purposes of definition three specific types of river restoration are covered by this report:

1. Multi-reach restoration (perhaps extending the entire length of a water body and sometimes encompassing on-line lakes).
2. Floodplain restoration (involving landtake and/or restoration of natural processes to a riparian area or floodplain). This category is also taken to include (in the context of this report) managed realignment for flood defences on rivers and transitional waters as well as more conventional re-meandering projects.
3. Catchment approaches. A broad view of catchment approaches is taken here rather than envisioning complete restoration to a pre-determined state. This is considered to be a framework that takes account of all the main processes and restraints that operate at that scale (cf. Bannister et al., 2005).

These types throw up specific challenges, including:

- A desire to take a whole catchment view.
- A need to take a longer-term view (e.g. an acceptance that habitat succession could take decades).
- The need for a mix of planning, regulatory and funding mechanisms.
- A broader-based partnership approach is required.
- The necessity to conduct wider stakeholder consultation.
- An aspiration to deliver multiple benefits.

With increasing scale, river restoration should be based on multi-disciplinary, adaptive management approaches and the acceptance that change will occur over time. With increased scale, there is a greater need for public involvement in planning, monitoring and appraisal, social processes, and the interaction between stakeholders are arguably increasingly important.

It is worth noting that water quality improvement in European Rivers (e.g. driven by improved sewage treatment) is a more established form of river management, sometimes stretching back many decades within individual EU Member States. This in effect is an early form of 'catchment clean up', albeit of water quality. There have been major river basin projects (e.g. the Mersey Basin Campaign) which has been ongoing for 25 years. Water quality improvement can be a prelude to physical restoration measures.

## 1.4 Approach and Methods

The approach used to compile this report combined a desk study of available information and informal interviews by telephone with key players in the UK and some European contacts provided by the Environment Agency (Appendix A).

Generally there is a large body of literature on the subject of policy drivers related to river restoration. A selection was made of key papers and reports involving a range of scientific and academic viewpoints as well as the opinion of EU policy makers as recorded in the presentations and reviews that they have prepared. These are referenced throughout the report.

A series of prompt questions were used to facilitate discussion with the stakeholders consulted as part of this project (Appendix A). The purpose was to confirm the key drivers, barriers and constraints, as well as opportunities and case studies of good practice.

In its draft form this report also elicited further additions and comments from key stakeholders in the project.

# 2 Key Drivers Leading to Legislation and Policy

## 2.1 Introduction

This section looks at the key drivers leading to legislation and policy requiring river restoration tools and techniques. It provides and overview of EU legislation and policy and a selection of national, regional and local policies of individual Member States devised to facilitate or assist implementation. Generic issues are drawn out rather than an analysis of policy and policy effectiveness in Member States. More information about policy and institutional aspects of restoration in Germany, the UK, and France can be found in the book by Moss and Monstadt (2008). There has been considerable rhetoric amongst academics (e.g. Potter, 2008) and practitioners (Blackwell and Maltby, 2006) on the challenges (and opportunities) surrounding existing policy instruments (e.g. Moss, 2008).

## 2.2 Drivers and Policy Shifts

The key drivers for policy on restoration over the past 30 years or so have traditionally included, to varying degrees, one or more elements, including:

- Environmental protection and nature conservation.
- Water protection.
- Fisheries management.
- Flooding and flood risk management.
- Landscape (e.g. urban planning).
- Projects by private developers and individuals.

To meet the challenges of delivering catchment-scale and floodplain restoration, policy makers are now having to re-evaluate existing institutional regulations and incentives. Some of the challenges, leading to policy shifts, that have emerged during the past decade are shown in Table 2.1. These are generalisations and there are differences/ different drivers within individual Member States. In some countries (e.g. the Netherlands) these drivers have led to significant policy changes long before implementation of an EC Directive. Some examples are given in Table 2.1. There has been increased understanding by stakeholders of problem identification and problem-solving under existing legislation and policy, principally in the related fields of water and land use. This heightened awareness is arguably creating new opportunities.

The following part of the report focuses on listing the key current EU legislation and policy, as well as some national examples of note. Some of the examples are therefore parochial, although nearly all of the issues have been selected as pan-European. EC Directives have traditionally been 'command and control' instruments; however more recent Directives (e.g. the WFD) are far more flexible and have shifted towards negotiated agreements recognising regional diversity and the need for integration across policy sectors as well as public involvement. The Directives and policies can generally be grouped into two categories:

- Those that *drive* the delivery of large-scale restoration because restoration offers a means of achieving the objective (s) of the Directive or policy, and
- Those that *support* the delivery of large-scale restoration, through wider environmental improvements such as water quality, without which a

restoration project could fail. In these instances, restoration does not necessarily achieve the objectives of the Directive or policy.

**Table 2.1. Policy shifts conducive to more holistic restoration (based partly on Moss, 2004 and 2007).**

| Policy Area | Reasons for change | Policy shift |
|---|---|---|
| Flood protection | EC Floods Directive. Major flooding events across Europe; prohibitive costs of maintaining flood barriers; growing evidence base for climate change *(Note: in the Netherlands, for example, floods in 1995 and 1997 prompted significant changes long before implementation of the Floods Directive)* | Flood risk management (including use of floodplains for natural storage of water). |
| Water protection | EC Water Framework Directive. Concerns over water quality/ quantity and morphological status | Catchment-wide approaches (including use of river morphology to determine ecological status and ecological potential) |
| Climate Change | EU Climate Change Adaptation Policy. Concerns over negative impacts of climate change (such as flooding) | Climate change impacts to be considered in key policy areas |
| Nature Conservation | EC Habitats Directive. Concern over continued loss and deterioration of valuable habitats (rather than reversing) *(within the Netherlands a key nature driver was internal policy on "Ecological Main Structure with Ecological Corridors", which preceded the Natura 2000 Network and within the UK a Convention on Biological Diversity led to Biodiversity Action Plans which are now pan-European).* | Increased promotion of functional floodplain ecosystems |
| Land-use planning | Highlighted linkage between flood events and land use | Planning mechanisms for protection and creation of flood retention areas |
| Agriculture | Inefficiencies of agricultural production; environmental degradation; heightened public health concerns | Improved and more extensive agri-environmental schemes; realisation of the significance of diffuse pollution for farming. |
| Rural Development | EU Rural Development Programme *(The Dutch RDP does not have strong linkages with restoration; in the Netherlands there are national funds made available for restoration under the "Blue-Green Services" policy).* | More integrated approaches based on rural economic development. Integration of agriculture and nature conservation. |

## 2.3 Drivers of Restoration

### 2.3.1 Habitats and Birds Directives

The EC Habitats Directive arose from the United Nations Convention on Biological Diversity. Coupled with the Birds Directive it seeks to create a network of designated areas (see www[1]) to protect habitats and species of EU importance, using a biogeographical basis. Since all Natura 2000 sites are required to be protected from deterioration or damage, it is in practice a 'no-net-loss' policy. Thus any plan or proposal likely to have a significant effect on a Natura 2000 site must undergo an Appropriate Assessment. Plans or projects can only proceed on the strict basis that there is no suitable alternative and where implementation is of over-riding public interest. For particular priority species and habitats (as listed in Article 4 of the Directive) then more stringent criteria are applied. The Habitats Directive was transposed into UK law through the 1994 Habitats and Conservation Regulations.

The EC Habitats Directive provides a potential means of delivering large-scale restoration. Where a development project affects a protected site and causes a loss of habitats then there is a requirement to create habitats of equivalent conservation status close by.

The Birds Directive (Directive 2009/147/EC) is concerned with conservation of wild birds (this is the codified version of Directive 79/409/EEC as amended) and is the EC's oldest piece of nature legislation and one of the most important, creating a comprehensive scheme of protection for all wild bird species naturally occurring in the Union. It was adopted unanimously by the Members States in 1979 as a response to increasing concern about the decline in Europe's wild bird populations resulting from pollution, loss of habitats as well as unsustainable use.

### 2.3.2 Water Framework Directive

The Water Framework Directive (WFD) is part of a newer generation of 'learning' Directives, allowing Member States to test alternative policies, adjust measures to match regional and national practicalities (including existing practices and institutional structures for example) and adapting policies in the light of experience.

The Water Framework Directive is one of the most far-reaching and demanding pieces of EU legislation to date. Its objectives are to:

- Prevent further deterioration in the water environment.
- Protect and enhance aquatic habitats.
- Promote the sustainable use of water.
- Reduce surface water and groundwater pollution.
- Mitigate the effects of floods and droughts.

The overall aim is to secure good ecological status for all water bodies, taking into account biological and chemical quality, water quantity and the physical structure of water bodies. The Directive is implemented through management plans for designated river basins (rather than according to administrative or political boundaries. These River Basin Management Plans (RBMPs) draw heavily on inputs from stakeholders and are updated on a six year cycle.

A paper by two University academics in the UK, Wharton and Gilvear (2006), describes some of the key ways in which the river restoration has the potential to

deliver ecological improvements in rivers consistent with WFD targets, whilst at the same time accommodating more sustainable flood management:

- Recognising that successful river restoration requires the reinstatement of the physical habitats as the foundation for ecological recovery.
- Recognising the river basins as a fundamental natural, geographical and hydrological unit will have a profound influence.
- Recognising the importance of managing land and water together (floodplains for flood storage and a catchment approach for tackling issues such as fine sediment).

To achieve the WFD targets, Member States need to continue to engage in an intensive restoration agenda. Overall pan-Europe, the WFD is still behind schedule and not all Member States are likely to meet the targets that all EU waters reach good status by 2015 (although with good justification, the targets can be delivered later). For some countries RBMPs have not yet been published. Despite these setbacks, many Member States have identified the toolkits of measures. The UK Government has developed a Mitigation Measures Manual, available on line (see www[2]). This was developed following a review of a scientific evidence base, as a single source of advice for a wide range of practitioners and river and coastal managers. It intelligently signposts users to the best available design guidance for different types of engineering activity, and will be updated in future as more knowledge and information becomes available. It provides guidance on the practicable use of measures and their ecological benefits as well cross-referencing to more detailed technical design guidance.

In terms of measures undertaken to date, then the most cost-beneficial include the removal of physical barriers (e.g. weirs); the installation of buffer strips and fencing and control of invasive species. Projects such as large scale re-meandering are relatively costly and have tended not to be promoted as a means of meeting WFD targets.

### 2.3.3 Floods Directive

Between 1998 and 2004 Europe suffered over 100 major damaging floods, including the catastrophic floods along the Danube and Elbe rivers in summer 2002. Severe floods in 2005 further reinforced the need for joint action. Since 1998, floods in Europe have caused some 700 deaths, the displacement of about half a million people and at least €25 billion in insured economic losses. These losses drove Directive 2007/60/EC on the assessment and management of flood risks which was proposed by the European Commission on 18/01/2006, and was finally published in the Official Journal on 6 November 2007. Its aim is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The Directive requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish flood risk management plans focused on prevention, protection and preparedness by 2015. The Directive applies to inland waters as well as all coastal waters across the whole territory of the EU.

It is stipulated that the Directive shall be carried out in coordination with the Water Framework Directive, notably by flood risk management plans and RBMPs and through coordination of the public participation procedures in the preparation of these plans. All assessments, maps and plans prepared shall be made available to the public. Member States shall furthermore coordinate their flood risk management

practices in shared river basins, including with third counties, and shall in solidarity not undertake measures that would increase the flood risk in neighbouring countries. Member States shall take into consideration long term developments, including climate change, as well as sustainable land use practices in the flood risk management cycle addressed in this Directive.

The direct relevance to river restoration is illustrated, for example, through the implementation of this Directive into Scottish law as the Flood Risk Management (Scotland) Act 2009. In this Directive the Regulatory body, the Scottish Environment Protection Agency (SEPA) is asked whether the " *alteration….or restoration of natural features and characteristics…could contribute to management of flood risk* " (also referred to as natural flood management). In England the Pitt Review of the summer 2007 floods identified clear gaps in the way that flood risk is managed (Cabinet Office, 2007). Under the Flood and Water Management Act (2010) local authorities now have responsibility to maintain or restore natural processes when mitigating floods. The Flood Risk regulations in England are implicit about the need to integrate the WFD and Floods Directives.

### 2.3.4 UN Biodiversity Plan

In November 2010 Member States of the United Nations adopted a new 10-year global strategy designed to halt the loss of the world biological diversity, with countries agreeing to draft national implementation plans to safeguard genetic resources within two years. Environment ministers from 193 countries attending a two-week conference of parties to the UN Convention on Biological Diversity (CBD) in Nagoya (Japan). By signing the Nagoya Biodiversity Compact, countries agreed on targets to reduce the loss of natural habitats by half and raise nature reserves to 17 per cent of the world's land area and 10 per cent of marine and coastal areas by 2020.

### 2.3.5 EU 2020 Biodiversity Strategy

The future of nature conservation depends on a holistic integrated approach. This was the overriding findings of an EU meeting on Water and Biodiversity held on 9 February 2011at the European Parliament by the Intergroup on Climate Change, Biodiversity and Sustainable Development (www[3]). The EU target for 2020 is "*Halting the loss of biodiversity and the degradation of ecosystem services……and restoring them in so far as is feasible, while stepping up the EU contribution to averting global biodiversity loss*." An EU 2020 Biodiversity Strategy will be adopted during 2011. This strategy will be clear and implementable and will focus on a reduced number of sub-targets allowing a prioritised approach. An ecosystem approach to conservation will be taken, recognising and valuing goods and services to ensure protection. At the meeting in February 2011, the importance of hydrological ecosystems was stressed by the Senior Advisor Europe (Ramsar Convention Secretariat). Wetlands are important in relation to climate change and peatlands, for example, store 25% of all terrestrial carbon. It is anticipated that over the next 10 years the restoration of ecosystems will play a key role. A target has been set for 15% of degraded ecosystems to be restored by 2020. The decision on what ecosystem services should be restored first will be left to Member States and be informed by the mapping of ecosystem services in each Country. To achieve the new biodiversity target, the EU will need to engage in an intensive and new restoration agenda over the next decade.

### 2.3.6 Rural Development Programmes

The essential rules governing rural development policy for the period 2007 to 2013, as well as the policy measures available to Member States and regions, are set out in Council Regulation (EC) No. 1698/2005. Under this regulation, rural development policy is focused on three themes (known as thematic axes). These are:

- Improving the competitiveness of the agricultural and forestry sector.
- Improving the environment and the countryside.
- Improving the quality of life in rural areas and encouraging diversification of the rural economy.

To help ensure a balanced approach to policy, Member States and regions are obliged to spread their rural development funding between all three of these thematic axes. A further requirement is that some of the funding must support projects based on experience with the Leader Community Initiatives. The 'leader approach' to rural development involves highly individual projects designed and executed by local partnerships to address specific local problems. Each Member State (or region, in cases where powers are delegated to regional level) must set out a rural development programme, specifying what funding will be spent on which measures in the period 2007 to 2013.

### 2.3.7 Climate Change Adaptation Policy

In April 2009 the European Commission presented a White Paper on adaptation to climate change (www[4]). This paper presented the framework for adaptation measures and policies to reduce the European Union's vulnerability to the impacts of climate change. The White Paper highlights the need "*to promote strategies which increase the resilience to climate change of health, property and the productive functions of land, inter alia by improving the management of water resources and ecosystems*".

As part of the actions included in the White Paper, Water Directors of EU Member States in December 2009 adopted a guidance document on adaptation to climate change in water management to ensure that the RBMPs are climate-proofed (European Commission, 2009). The Commission, by 2012, will present a 'Blueprint to Safeguard European Waters', which, together with the analysis of all plans for 110 river basin districts, will perform a review of the Strategy for Water Scarcity and Droughts and of the vulnerability of water and environmental resources to climate change and man-made pressures. It will be based on an assessment of vulnerability of water resources and of adaptation measures at EU level, undertaken by a combination of quantitative modelling and stakeholder discussions. The work included a recommendation for ensuring that climate change is taken into account in the implementation of the Floods Directive. The guidance also includes topics such as measures to boost soil storage capacity for both water and carbon and natural water retention measures such as restoration of floodplains, natural water retention in upstream parts of river basins by reforestation, natural flood defence measures, sustainable urban drainage systems, wetland restoration and soil management (European Commission, 2009).

It is widely recognised that climate change makes riparian restoration more vital than ever (European Commission, 2008). Riparian ecosystems are naturally resilient, provide linear habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife (Seavy et al, 2009). These are all aspects that can contribute to ecological adaptation to climate change. Other authors have

advocated that more consideration should be given to the implications of climate change for restoration practice (Harris et al., 2006). Restoring riparian ecosystems may also reduce the impacts of extreme flood events. Since climate change will have different effects geographically then restoration practitioners need to consider how (at a local or regional level) they can modify practices to enhance the resilience of riparian ecosystems to climate change.

### 2.3.8 Land Use Planning Policies

Spatial planning has the potential to be an effective mechanism for river restoration and in particular for adopting a more integrated approach to land management.

The Planning and Compulsory Purchase Act 2004 brought in a new Development Plan system for England consisting of Regional Spatial Strategies (RSSs), to provide strategic planning guidance for each region, as well as Local Development Frameworks (LDFs) to provide the local spatial planning strategy. The regional spatial plans tend to acknowledge the importance of specific designated environmental sites (such as SSSIs or SAC/SPAs), and include appropriate safeguards where there are potential impacts on those sites. However, RBMPs will require that impacts on any water body be considered within regional spatial plans. At the strategic planning level, the inclusion of WFD and RBMP objectives is most relevant in terms of the need to preclude new developments on floodplains and the creation of 'buffer areas' between developments and watercourses, e.g. 'blue belts'. 'Green Infrastructure', delivered by the spatial planning system also promotes a wide range of benefits for people and the natural environment and includes protection and enhancement of river corridors.

Planning Policy Statements (PPS) set out the Government's national policies on different aspects of planning in England (Communities and Local Government, 2005). PPS9 sets out planning policies on "*protection of biodiversity and geological conservation*" through the planning system. It is a particularly important policy as it recognises the importance of wildlife corridors and requires this to be a consideration in each development. This type of policy has helped support policies such as the Greater London Authorities 'Blue Ribbon Network' (www[5]). Similarly in Wales there is a Technical Advice Note (No.5) relating to planning and nature conservation. Local Development Frameworks (LDFs) in England and Wales are a mechanism for spatial planning (since 2004) and they have very occasionally been used to set out the policy need for restoration as part of a development.

A number of other PPSs in England include polices and provisions that require water to be managed sustainably when planning for growth and for ways to protect the natural environment. These policies and provisions support some of the intentions of Future Water, the UK government's overall policy on water issues. Specific references to WFD are made in the following PPSs:

- Regional Spatial Strategies (PPS 11)
- Planning and Pollution Control (PPS 23)
- Development and Flood Risk (PPS 25)

## 2.4 Supporters of River Restoration

The second tier of policy drivers comprises those that don't specifically mention or elude to river restoration but play a potentially vital role in delivering successful restoration. While river managers have traditionally been impotent to change land

use, these Directives and policies promote approaches to land management that are essential to the delivery of successful large-scale restoration projects.

### 2.4.1 Common Agricultural Policy

Farms and forests are vital for Europe's health and economy. The EC's Common Agricultural Policy (CAP) ensures that farming and preservation of the environment go hand-in-hand. It helps shape the economic and social fabric of rural communities and plays a vital role in confronting new challenges such as climate change, water management, bioenergy and biodiversity. The EC's CAP is constantly evolving. Fifty years ago the emphasis was on providing enough food for a Europe emerging from a decade of war-induced shortages. Subsidising production on a large scale and buying up surpluses in the interests of food security are now largely an action of the past. Financial safety nets are still in place, but are used much more selectively. For example, the CAP steps in with financial support for farmers hit by natural disasters or outbreaks of animal diseases. Where necessary, the CAP supplements farm income to ensure that farmers make a decent living. However, assistance is linked to compliance with broader objectives including control of diffuse pollution and bird and wildlife conservation (both potentially key elements of river restoration). EU research budgets further support innovation in agriculture by increasing productivity whilst making farming more environmentally friendly.

### 2.4.2 Nitrates Directive

Council Directive 91/676/EEC (hereafter referred to as the Nitrates Directive) concerning the protection of waters against pollution caused by nitrates from agricultural sources was adopted on 12 December 1991. A sister Directive 91/271/EEC (Urban Waste Water Treatment) was adopted on 21 May 1991. Article 10 of the Nitrates Directive requires that Member States submit a report to the Commission every four years following its notification. This report should include information pertaining to codes of good farm practice, designated Nitrate Vulnerable Zones (NVZs), results of water monitoring and a summary of relevant aspects of actions programmes for vulnerable zones.

Reduction of nitrates from fertiliser applications is a key tool for the improvement of water quality and therefore vital for river restoration in general. Farmers cannot receive supporting payments to induce them to meet the reduction in fertiliser application required by the Directive. That is, they cannot be compensated for what should be day-to-day good practice. They can, however, receive capital grants for the construction of manure storage facilities.

### 2.4.3 Groundwater Directive

Another key Directive which is directly relevant to river restoration is the new Groundwater Directive (2006/118/EC). This establishes a regime which sets underground water quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The Directive establishes quality criteria that takes into account local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge. The Directive thus represents a proportionate and scientifically sound response to the requirements of the Water Framework Directive (WFD) as it relates to assessments on chemical status of groundwater and the identification and reversal of significant and sustained upward trends in pollutant concentrations. Member States will have to establish the standards at the most appropriate level and take into account local or regional conditions.

### 2.4.4 Soils Directive

Different EU policies (for instance on water, waste, chemicals, industrial pollution prevention, nature protection, pesticides, agriculture) are contributing to soil protection. As these policies have other aims and other scopes of action however, they are not sufficient to ensure an adequate level of protection for all soil in Europe. For all these reasons, the Commission adopted a Soil Thematic Strategy (COM(2006) 231) and a proposal for a Soil Framework Directive (COM(2006) 232) on 22 September 2006 with the objective to protect soils across the EU. Despite the efforts of several Presidencies, the Council has so far been unable to reach a qualified majority on this legislative proposal due to the opposition of a number of Member States constituting a blocking minority.

### 2.4.5 Other Directives

There are other Directives which have a bearing on integrated river basin management through water quality improvement, namely the: Bathing Water Directive (2006), the Drinking Water Directive (1998) and the Urban Wastewater Directive (1991). These are not examined further in this report.

# 3 Implementation: Barriers, Constraints and Opportunities

### 3.1.1 Introduction

This section is concerned with barriers, constraints and opportunities to implementation. A barrier is taken to be an obstacle that prevents a particular policy driver being implemented, or limits the degree to which it can be implemented. Barriers can be both rigid and flexible, the latter being able to be overcome given sufficient time or resources. Emphasis is placed in the discussion on how to overcome such barriers rather than avoid. Some key opportunities identified in individual Member States which could perhaps have wider or indeed pan-European application are highlighted for certain sections. This is considered to be an example of the need for information exchange. Challenges and opportunities for individual projects that have been implemented are dealt with in Section 4 and Appendix B. There are considerable previous experiences to learn from, albeit we are arguably still in the infancy of the evolution of river restoration.

Whilst there is continued rhetoric for further policy shift, there is considerable opportunity that can be derived from the existing legislation and policy if directed at a national, regional or local level in the most advantageous way. If we are to step up a level to even more holistic and integrated approaches to river restoration (perhaps on a much larger scale) then arguably a shift of policy at EU level, perhaps involving further CAP reform, will be required.

### 3.1.2 Policy

This section first provides a very brief overview of WFD implementation in EU Member States, particularly the extent to which effective plans have been published. It then addresses specific barriers to policy.

### 3.1.3 European Overview of WFD

Taking a pan-European perspective then there is significant variation in the implementation of the Water Framework Directive. Member States were supposed to have completed their draft plans and opened them for consultation for six months by the end of 2008 and the first River Basin Management Plans should have been published by a deadline at the end of 2009. However at a European Water Conference in Brussels in April 2009 concerned with monitoring WFD progress, the Commission announced that only 16 countries had published their draft plans (www[6]). Others had partially done so, but eight countries had put nothing out to consultation at all. In particular it was found that southern European countries were lagging behind, which was considered worrying as southern Europe is an area with more visible and multiple water problems. A further finding was that whilst some countries had already started costing the measures, other plans were way behind and were full of exemptions. The reasons given for the irregularities are varied including the complexity and wide ranging scope of the WFD requiring Member States to make radical policy shifts. There is a need, for example, for ensuring compliance with other water-related legislation. However a key factor in limiting progress in 2009 was the cost of funding the measures. Most Member States had underestimated the scale of investment required and this was regarded as a major deficit in the drafted plans. The prospect of implementing measures such that all EU waters reaching good status by 2015 was considered to be highly unlikely. It was felt that some Member States would push for time exemptions.

In 2010 the European Environmental Bureau undertook a snapshot investigation into the effectiveness of WFD implementation and found that in general RBMP's fail to provide adequate information to tackle pressures (www[7]). However a press release by the European Water Association on 22nd December 2010 indicated that RBMP's had been adopted by the majority of Member States (www[8]) The EU is to conduct a full review of WFD implementation in 2012 (this is being currently referred to as a 'water blueprint').

For this high-level review is was not possible to undertake a review of the implementation plans of each of the 27 EU Member States and to assess the comprehensiveness of measures referred to in individual plans. Access to detailed information has proved difficult for some investigators (see www[7]). Table 3.1 provides links to official government WFD web sites in Member States where the reader should be able to find recent information. Some of these sites contain relatively detailed information about progress with WFD, others less so.

**Table 3.1. Links to Government WFD Websites**

| Country | www links (checked 4 June 2011) |
|---|---|
| Austria | http://www.lebensministerium.at/wasser/ |
| Belgium | http://eau.wallonie.be/<br>http://www.ciwvlaanderen.be/ |
| Bulgaria | http://www.moew.government.bg/ |
| Cyprus | http://www.wfd.wdd.moa.gov.cy/ |
| Czech Republic | http://www.env.cz/<br>http://www.mze.cz/ |
| Denmark | http://www.mst.dk/vand/06000000.htm |
| Estonia | http://www.envir.ee/ |
| Finland | http://www.ymparisto.fi/ |
| France | http://www.eaufrance.fr/ |
| Germany | http://www.bmu.de/gewaesserschutz<br>http://wasserblick.net/ |
| Greece | http://www.minenv.gr/welcome_gr.html |
| Hungary | http://euvki.hu/ |
| Ireland | http://www.wfdireland.ie/ |
| Italy | http://ec.europa.eu/environment/water/water-framework/implrep2007/pdf/sec_2007_0362_en.pdf |
| Latvia | http://www.lvgma.gov.lv/ |
| Lithuania | http://aaa.am.lt/ |
| Luxembourg | http://www.waasser.lu/gestion_de_leau/gestion.html |
| Malta | http://www.mra.org.mt/wfd_introduction.shtml |
| Netherlands | http://www.kaderrichtlijnwater.nl/<br>http://www.waterland.net/ |
| Poland | http://www.rdw.org.pl/index.php |
| Portugal | http://dqa.inag.pt/ |
| Romania | http://www.rowater.ro/ |
| Slovakia | http://www.enviro.gov.sk/ |
| Slovenia | http://www.mop.gov.si/ |
| Spain | http://www.mma.es/portal/secciones/acm/politica_agua/directiva_marco_aguas/ |
| Sweden | http://www.vattenportalen.se/ |
| United Kingdom | http://archive.defra.gov.uk/environment/quality/water/wfd/index.htm<br>http://www.scotland.gov.uk/Topics/Environment/Water/15561/WFD<br>http://www.ni-environment.gov.uk/water-home/wfd.htm |

CIRF was briefly interviewed for this project. At the time of writing the difference in progress between Northern Europe and Southern Europe (noted in 2009) were confirmed as still being valid. Italy and Greece have been slow to publish RBMP's and they are considered not to be effective tools. Progress has also been very slow in other Mediterranean countries such as Spain with the exception of (southern) France where there are examples of good practice, including large scale interventions (CIRF, pers. comm.). In Portugal and Slovenia there has been no progress to date. The key barriers appear to be cultural and in Italy there is currently a total lack of action by the Ministry of Environment (CIRF, pers. comm.)

### 3.1.4 Specific Policy Issues

There are constraints surrounding the inflexibility and lack of clarity of European and individual Member State legislation and policy. There may be inconsistencies in some Member States between EU and national policies and there is much rhetoric on these subjects and calls for shift of policy. A key barrier that has been identified by some of the practitioners questioned for this review is that it is not the policy per se that it the prime obstacle, rather it is the lack of translation of policy and guidance to the local level and to implementation.

The Habitats Directive is perhaps the prime example of legislation that has not always led unambiguously to environmental gains (Ledoux et al., 2005). This is partly because this is an older-style Directive which has had a restrictive official interpretation (in the UK). For example, in the past managed realignment for flood risk management (and habitat gain) has required habitats of equivalent conservation status to be recreated close by. Managed realignment of a flood defence structure in a transitional water can lead to the loss of freshwater habitats such as grazing marshes notified as Special Protection Areas (SPA's). Any displaced habitat should be compensated for elsewhere even if the scheme itself leads to the creation of a different type of habitat. Resolving such issues has traditionally taken a long time due to legal processes. Stakeholder consultation led by Ledoux et al (2005) showed that the Habitats Directive was one of two key constraints to managed realignment. It was suggested that there should be a more flexible interpretation of the Habitats Directive, with recognition given to the dynamic nature of habitats and criteria for suitable compensatory habitats sites based on structural and functional processes. That is, rather than create habitats nearby then a more strategic approach should be undertaken, including recreation of major habitats on a strategic basis. A suggested policy action is to combine the Habitats Directive and the Biodiversity Action Plan.

Closer alignment of policy is required to enable the more comprehensive and integrated catchment approaches. There are currently multiple national policies in Member States of relevance to river restoration. Examples of key areas where there is a call for more integration at either the policy level or operational level include:

- Floods and conservation.
- Floods and land use.
- Water protection and agriculture.

A key issue is the links between WFD and Birds and Habitats Directive (BHD). A workshop on biodiversity was held in Brussels (17-18 June 2010) specifically with the intention of exploring integration of the two Directives. According to the findings of the workshop there are more synergies than differences between WFD and BHD (www[9]). It was recognised that there is a need to exploit the synergies but recognise the differences.

A guidance document has been produced under the framework of the Common Implementation Strategy concerned with the role of wetlands in implementation of the EC WFD (European Commission, 2003). Wetland creation and enhancement can, in appropriate circumstances, offer sustainable, cost-effective and socially acceptable mechanisms for helping to achieve the environmental objectives of the Directive. In particular, wetlands can help to abate pollution impacts and contribute to mitigating the effects of droughts and floods. This guidance includes a programme of measures for improved wetland management. Implementation of the findings by Member States is not obligatory but at their discretion.

### 3.1.5 Example Opportunity: A Mix of Policy Instruments

Combining policy initiatives can create an opportunity for initiating a restoration project. As an illustration (from the UK) individuals within the Environment Agency believe that bringing together different policy areas may potentially lead to a more integrated approach to the delivery of restoration. Three current initiatives could be brought together to assist (see full description in Section 3.17):

- Strategic flood risk management at the catchment scale.
- The (current) Government White Paper on ecological restoration zones.
- Local catchment planning initiatives involving local people.

## 3.2 Funding Arrangements

The UK Cabinet Office (2007) suggested that as floodplain restoration practice was still not being reflected by results on the ground, more effort is required on finding and securing land for floodplain restoration. Purchase of rights of use of land (e.g. easements or covenants) or purchase of land outright are seen as key constraints to more holistic forms of restoration. In general terms, there have been inadequate incentives for farmer to accept change of land use. Another challenge is that a mix of funding arrangements and voluntary agreements may be the preferred solution. For example flood defence funding for the initial project and then agri-environment schemes for the maintenance element.

For restoration involving land take on private land then there may be a need to compensate landowners. There is not only the potential change of the physical footprint of a watercourse (e.g. through re-meandering), but also the potential impact of increased natural flooding or erosion as a consequence. Compensation might therefore take the form of land acquisition or payments for loss of use of the land (without the land registry title being transferred). In the authors' experience, compulsory purchase of land in the UK is a less attractive and often a difficult option to pursue for both the existing landowner and future operator of a site.

There are a variety of mechanisms in Members States for compensation. As an illustration a key potential mechanism for payments to farmers and other land managers in England is the Environmental Stewardship (ES) scheme (ES). This scheme replaced the Countryside Stewardship Scheme, first introduced in 1991, and it is managed by Natural England. ES is an agri-environment scheme that provides funding in England to deliver effective environmental management. Two key objectives are the conservation of wildlife and biodiversity and provision of flood management. Four key elements of stewardship are:

- Entry Level Stewardship (ELS) providing a straight forward approach to supporting good stewardship of the countryside (Agreements are legally binding and run for 5 Years).

- Organic Entry Level Stewardship (OELS) (can include buffer strips).
- Higher Level Stewardship (HLS) involving more complex types of management and agreement that are tailored to local circumstances (Agreements run for 10 years).
- Uplands Entry Level Stewardship (Upland ELS) aimed at supporting hill farmers with payments for environmental management.

It is thought that agri-environment schemes are potentially a useful instrument, particularly where land use change is not irreversible such as occasional flooding of land (e.g. due to a restoration project or climate change). This might obviate the need to permanently acquire the land. However, in the UK at least, these schemes are inflexible. Considering that river restoration should have a long term vision, then a 5 or 10 year agreement is very limited. For example, if water is to flood an area following the breaching or removal of an established flood defence then a landowner may have significant concerns over the long term financial and practical impacts. Also Natural England have found schemes unsuitable where a restored river is allowed to naturally migrate across its floodplain. Agri-environment schemes are currently founded on fixed field boundaries. To build in natural migration, the rules will need to be changed and passed through Europe as well as national Governments.

In terms of more immediate opportunities there are funding mechanisms in place in Member States that encourage river restoration. For example within the Environment Agency in England and Wales there is an annual allocation of grant in aid for flood risk management (FRCM), a proportion of which can be allocated (as appropriate and according to rules) to restoration of rivers. This is a long term programme of work and in the current year the total budget is €12.6 million. These monies can also be used to compensate landowners where appropriate. An outcome measure set by the UK Government in June 2011 for FRCM is the 'length of river improved' and this sets a clear signal for river restoration as part of FRCM activities.

Land management and flood risk management is a key area of interest (see DEFRA (2004) *Making Space for Water Policy*). There is evidence that even small scale catchment management approaches can store sufficient water to reduce or eliminate downstream flooding, albeit on a local scale. Large washland (storage) or managed realignment areas can be designed to store excess water and slow down flood peaks. There is less evidence that upstream storage can mitigate extreme flood events. In England and Wales the Environment Agency proposals include:

- To use flood risk management as a vehicle to deliver management and land use change where there is sufficient evidence to support the benefits.
- To work with Natural England to seek to maximise the flood risk management benefits in existing Environmental Stewardship options.
- To use agri-environmental schemes (i.e. wetland creation) and Catchment Sensitive Farming capital grants schemes to deliver flood storage through land use change on floodplains.
- To ensure (with Natural England) that Environmental Stewardship payments for woodland creation and managed realignment help deliver sustainable flood risk management approaches.
- To help ensure that flood risk management becomes an objective of the England Catchment Sensitive Farming Delivery Initiative.

Such initiatives are significant for river restoration as the design and restoration of wetlands as part of flood risk management schemes is a key opportunity to reverse

the decline, and achieve targets for local and national biodiversity action plans for habitats and species and contribute to flood storage.

Within Scotland, the Scottish Parliament has established a restoration fund (Scotland's Water Environment Restoration Fund) which can be used for a number of purposes including compensating landowners. This fund contributed over €1.7 million to projects across Scotland between 2008 and 2010. These monies are directed and managed by a Restoration Assessment Group, led by the Scottish Environment Protection Agency (SEPA) but also including Scottish Natural Heritage (SNH), Scottish Government and the Forestry Commission Scotland. The fund is open to a wide range of interest groups including community groups, fisheries trusts, environmental charities and landowners. Projects should aim to improve the environmental status or condition of a water body by tackling the physical pressures on that system. DEFRA (in England) have recently announced their intention to establish a Catchment Restoration Fund from 2012 (www[10]) (Section 3.4).

The generally rigid nature of the mechanisms for providing compensation in Member States represents a residual barrier. Some argue for more flexible mechanisms that allow for successful engagement of stakeholders and more creative forms of compensation. In terms of overcoming barriers there have been a number of suggestions:

- Closer integration between the rural development and flood risk management functions in terms of planning, delivery and funding.
- Contractual arrangements need to be simple.
- Contractual arrangements need to be framed over the long-term with guarantees to deliver focused outcomes.

In the UK these recommendations are perhaps most relevant to managed realignment, which is normally a planned activity for replacing lost intertidal habitats.

However within the UK in general flood defence is a discretionary provision and landowners do not have the right to compensation where a decision is taken to cease defending their land. Some of those consulted for this review report have indicated that widespread compensation would in itself be a barrier to delivery of more natural systems. It is argued that a further shift is required in attitudes towards reduced maintenance and an acceptance of the wider benefits and outcomes of doing this.

In general terms, agricultural policy in Europe is changing and more emphasis is being placed on environmental enhancement and on delivering public benefits. The Rural Development Plan (RDP) introduced in 2007 recognises the role of agriculture in sustainable flood management and provides reward to farmers through the Land Management Contract Scheme. The RDP provides farmers with advice and plans to enable the agricultural sector to contribute towards achieving WFD objectives. Agriculture and the Agenda 2000 reform of the EU CAP has allowed Member States to attach environmental conditions to the payment of subsidies for agriculture. This could potentially lead to less intensive agriculture on floodplains. The concern of intensive farming practices on human health is also a key consideration to move in this direction. There is a consensus view that further changes to CAP policy are required.

### 3.2.1 Opportunity: Land Banks

A good example of practice in particular European Countries is that conducted by the Rural Service Area (Dienst Landelijk Gebied or DLG) in the Netherlands. This Government Agency works for a variety of authorities through land acquisition, design and it proposes areas for nature conservation measures (e.g. planting and management of forests). There are several areas of land management, such as advice, purchase (acquisition), management and sales. Purchase is often subject to long-term processes which could last several years. There is a shared approach to this process which covers:

- Planning
- Participation
- Communication
- Decision Making

Land Purchases of DLG often serve wider conservation objectives, frequently in conjunction with recreational facilities. This can include the construction of natural habitats, including wetlands. A major proportion of the land acquired by DLG is for 'ecological main structure' (known as EHS). EHS is a large network of interconnected natural areas. By 2018, the EHS aims to have acquired 728,500 acres of rugged and varied natural cover. By the end of 2009 nearly a third of this goal had been realised (through purchases of an agricultural and private nature). This is seen as a key mechanism for river restoration and a mechanism that could have wider application across Europe.

## 3.3 Finance

A number of those questioned for this project expressed concern over the current economic climate, and cuts on environmental spending. In addition, Raven (2011), for example, expressed a view on the potential 25% cuts in the public sector in the UK during 2011-2014. Budget restrictions will limit the overall expenditure on strategies and specific measures. He believed that cuts will also reduce capacity and experience (as experienced individuals take early retirement), potentially weakening statutory river management and conservation organisations.

However there is no doubt that there is considerable commitment within individual Member States to maintain funding for river restoration (including funding of WFD activities). For example in Bavaria (Germany) following the disastrous flood in 1999 a so called *'Action Programme 2020'* was launched (www[11]). This programme is an integral approach for flood risk management and consists of three areas of action, namely technical measures, natural retention and prevention. Within 20 years a sum of €2.3 billion will have been invested for the improvement of sustainable flood protection.

In 2011 the UK Government announced that an additional €106 million will be provided over the next four years to remove non-native invasive weeds and animals, clear up pollution, and remove redundant dams, weirs, landings and other man-made structures so that wildlife can thrive in water catchments across England (www[10]). The funding is to be shared between the Environment Agency, Natural England and civil society associations such as the Association of Rivers Trust to build on successful work. A significant portion of the funding will support new local projects across the country through a Catchment Restoration fund. Funding from the Catchment Restoration fund will be available from 2012 to co-fund projects that restore and protect the health of catchments by bringing together those responsible

for causing pollution, with those who want to see cleaner waters and the agencies that provide scientific evidence to base decisions on. An additional €21 million will be provided in 2011 to continue providing help to farmers to put in such measures as buffer strips and fences to protect watercourses and take other action to prevent agricultural pollution, under the successful Catchment Sensitive Farming programme. The institutional process for allocation of funds and screening proposals (e.g. on a technical basis) are yet to be formed.

The fact that funding is generally only available on a short-term basis is considered as a severe constraint in the UK. Often money has to be spent on a year-to-year basis, the money needing to be spent by the end of a financial year. This tends to restrict more holistic and meaningful restoration. What is needed is a more flexible approach to finance that takes a longer term view. One view expressed for this review by one of the contributors is that funds should be secured for whatever part of a restoration vision (over whatever period of time) and then used as a vehicle to attract other opportunistic funding. A staged approach to restoration may be applicable, tackling issues in order of priority (Mainstone and Holmes, 2010).

### 3.3.1 Opportunity: Benefits and Costs

A report prepared by English Nature, Environment Agency, DEFRA and the Forestry Commission (2003) provides a useful view on the environmental benefits of wetlands and washlands and their role in sustainable flood management. At one level the use of environment economics as a discipline to quantify environmental costs and benefits arising from river restoration is an advance. The multiple benefits arising from floodplain or catchment restoration need to be recorded. A particular discipline known as Ecosystem Services represents an increased recognition of the significance of the important services that ecosystem services provide to society. In Europe there is growing political ambition to maintain, and where necessary restore or enhance ecosystem services (IEEP, 2010). Ecosystem services can be direct (e.g. wood, pollination and erosion) or indirect (e.g. climate moderation, nutrient cycles and natural means of detoxification). These types of services are often undervalued in issues such as climate change and flooding as many of them are without market value. An essential condition for healthy ecosystems is the maintenance of ecological coherence. However, habitats throughout Europe are becoming increasingly fragmented. Many initiatives are already playing a role in tackling this issue, such as the Natura 2000 Network but given the scale of the challenge, more needs to be done to build an ecologically coherent green infrastructure for Europe for the benefit of all, people as well as nature (www[12]). The EU held its first working group on green infrastructure in March 2011.

Ecosystem services are not explicitly protected by EU legislation, however, existing Directives do provide protection for some aspects. For example, the EC Habitats and Birds Directives protect the status of the species and habitats listed in their annexes. Any damage to the status of these species or habitats may result in financial liability under the Environmental Liabilities Directive. Achieving good ecological status under the Water Framework Directive requires all the inputs and demands made on a river system to be managed to ensure good ecological status or potential of the water body. Protection of biodiversity is also being integrated into EU thematic strategies.

At a national level the UK Government's 2005 Sustainable Development Strategy identified a strategic approach to natural resource protection and environmental enhancement as one of four priority areas for the Government. Current Government conservation policies focus primarily on individual components of ecosystems, such

as species at risk, often in small pockets of high-value habitat. However, future policy may need to consider whole ecosystems that are at risk, taking action over larger areas of habitat to enhance ecosystem services. Action over a wide area will also be required to maintain ecosystem services in response to climate change. The UK Department for Environment Food and Rural Affairs (DEFRA) has developed an 'ecosystems approach', to conserve, enhance and manage the natural environment, in consultation with a group of relevant stakeholders. This led in 2007 to publication of an Action Plan to embed an ecosystems approach in policy and delivery by DEFRA and its partners (www[13]).

One of the recommendations of this work was that CAP should be refocused beyond 2013 to include a core objective of delivering ecosystem services. However, there are difficulties in determining how a market-driven economy can take account of ecosystem services that may not have market values and incorporating this into policy making. Equally there are difficulties in understanding how ecosystem services can be maintained or restored through policy or other measures due to the complexity surrounding the study of ecosystems in general.

## 3.4 Institutional and Administrative Boundaries

Institutional arrangements have shortcomings to varying degrees. These tend to be negative barriers as the legal powers to implement more holistic and integrated restoration are split between Agencies in all Member States. In several Member States water, wetland and land management is often divided within the same Agency, leading to conflicting approaches. The EU Wise Use of Floodplains Projects suggests that this has led to missed opportunities for large scale multi-functional restoration projects (www[14]).

Also, administrative boundaries remain a key barrier to collaboration in a catchment. In general, catchments involve more than one local or regional administration and may in some Member States, involve more than one region or area of the competent authority for water matters. Ledoux et al (2005) showed the difficulties in dealing with managed realignment (for example), involving a number of administrations. One person questioned for this review described "*the virtually impossible task of getting two neighbouring local authorities to speak to each along the same length of river (let alone the entire catchment)*". Rural Economy and Land Use (RELU) programme (2010) outline some of the challenges of working institutional boundaries.

There are some useful existing vehicles which can potentially be used to extend the 'catchment thinking' that is required by stakeholders in Member States. In the UK, DEFRA and the Environment Agency have adopted a strategy for sustainable catchment scale flood defence and this has provided the impetus for Catchment Flood Management Plans (CFMPs). These aim to provide "*integrated, technically, environmentally and economically sound and sustainable flood risk strategies*" at catchment level for the next 50 years (Environment Agency, DEFRA and National Assembly for Wales, 2002). Some of the CFMP's identify floodplain storage and recognise the additional potential benefit of floodplain woodland habitat creation.

## 3.5 Land Use Planning

Urban and regional planning is not a matter for the EU, rather it is a matter of competency for the individual Member States. Several of those questioned for this review felt that despite recent advances and evidence of flood risk, it is still hard to stop urban developments on floodplains (they are still occurring). In general

planning regulations fail to halt the loss of existing floodplains and remain ineffective in this respect. Water Regulators in most Member States have limited means of influencing land use. A leading practitioner questioned for this review described how they recently attended a workshop with planners on catchment management issues and the discussion took more than an hour before the word 'catchment' was mentioned.

The relationship between planning and flood risk management in the UK has been likened to a 'fish out of water' (Howe and White, 2004). This remains a key constraint to delivering floodplain restoration projects on the ground. There is also a failure of officers at local level to fully understand the concept of a catchment-wide approach. Whilst flooding and climate change are likely to remain high on the local agenda, according to several people contacted as part of this review, there is still a tendency for endorsement of a hard engineering solution (e.g. raising defences in an affected town) rather than thinking more holistically.

There is a need to ensure that planners 'think catchment' (www[15]) and also have access to relevant training in water and other environmental issues (see Section 3.13 on Capacity Building). Changes in regional planning could help this issue. However another constraint is that strategic planners often do not work alongside development control staff and communication between the two groups can be problematic. This has sometimes led to uncoordinated planning decisions and presented a barrier to implementation of strategic plans on the ground.

In several Member States neither Environmental Impact Assessment (EIA) nor Sustainability Appraisal/Strategic Environmental Assessment (SA/SEA) (from a land use planning perspective) are well aligned to reflect WFD or RBMP objectives. In the UK, local planning authorities only have a 'duty to have regard to' River Basin Management Plans and it is unlikely to be an issue high on their agenda. However many Government organisations have been proactive and the Environment Agency in England and Wales has developed a series of WFD guidance documents that ensure that WFD can potentially be fully integrated into planning processes. One of these is concerned with licensing and dredging and covers estuarine waters (www[16]) and has attracted wider interest from other EU Member States. The Environment Agency also ensures that its own flood risk management works are fully compliant with WFD requirements.

### 3.5.1 Opportunity: Watertoets (Netherlands)

The Dutch Watertoets (or *Water Test*) is an assessment designed to ascertain whether or not an adverse effect is likely to result from a change in status of surface water, groundwater or a water dependent habitat (e.g. wetlands) as a result of a project, plan or programme (www[17]). The results of this test allow a judgement as to whether to permit or approve the plan or programme. The key issue is that in order to assess the potential impact, the Dutch Government takes advice from water managers, provinces and municipalities, the polders etc. These individuals have a powerful position in that they can recommend rejection, modification, restoration or compensation for expected loss arising from a proposal.

### 3.5.2 Opportunity: Spatial Planning - Room for the River Programme (Netherlands)

The Room for the River programme (www[18]) is a specific approach to flood risk management adopted by the Dutch. It combines flood protection, master landscaping and the improvement of environmental conditions at the same time. The project is due to be active from 2006 until 2015. In 2006, the Dutch

Government proposed the Spatial Planning Key Decision (SPKD) as a result of flooding along the Rhine River Delta. Flooding in 1995 and 1997 caused devastation with over 200,000 people evacuated from the affected regions. The floods redistributed sediments across the floodplain further reducing the space available for annual flooding (enhanced by climate change). The SPKD looks for ways of allowing overbank flow through the removal of barriers that cause blockages, by increasing open areas and either adding or removing flood embankments to contain and direct flow. The project encompasses four rivers; the Rhine, the Meuse, the Waal, and the IJssel. The design is unique in that it presents an integrated spatial plan incorporating landscape master-planning, flood control and improvement of overall environmental conditions. Completion of a basic package covering forty individual projects is foreseen for 2015, with a budget of €2.2 billion.

The project can be linked with the Integrated Rhine Programme which extends beyond the Netherlands and includes Germany, parts of France and finally Switzerland. This programme has looked at measures such as flood storage/ flood attenuation in upstream countries.

### 3.5.3 Opportunity: Spatial Planning – Municipal Stormwater and Small Water Programmes (e.g. Sweden, Finland, UK, Germany)

Urban flooding caused by rainfall overwhelming drainage capacity is a key concern, now reflected in the EC Floods Directive and in individual legislation and policy of Member States. In urban areas, the impact of flooding can be very high because the areas affected are densely populated and contain vital infrastructure. Continuing development in flood-prone areas increases the risk. Urban flooding is also expected to increase with increased urbanisation and the threat of climate change. Sustainable Urban Drainage Systems (SUDS) in the UK and Germany, for example, can include green roofs, or natural water storage features like ponds or porous paving. Such features can encourage uptake of water by the ground ('infiltration') and reduced peak flow rates of runoff ('attenuation'). Pollutants can also be trapped or filtered out and ecological areas created. In Sweden and in Finland most large cities now have stormwater programmes to promote infiltration and retention with urban space. The programmes are a good basis for restoration of urban rivers and streams, which often suffer from peak flows (causing erosion) and poor water quality.

## 3.6 Multiple Floodplain Uses

Restoration of functional floodplains requires changes to existing activities on that floodplain and even as far as a catchment perspective. There are conflicts over floodplain use, namely agriculture, infrastructure, forestry, recreation, biodiversity and flood risk management. Floodplain land often has a relatively high value, limiting its use for activities such as floodplain restoration. Topography is generally appealing for agriculture and urban development. Floodplain soil is typically highly productive resulting in high agricultural land values. Proposals for change of land use on floodplains can cause confrontation with vested interests. Traditionally there have been other (adverse) funding sources for floodplains such as monies for increasing agricultural production or monies for flood risk management which potentially conflict with current environmental values and objectives.

## 3.7 Agriculture and Sediment Sources

The Common Agricultural Policy has traditionally meant counter-productive financial incentives to restoration. Financial incentives (or rather the lack of) in relation to farmers and agricultural activities are considered in Section 3.3. Conflicts of floodplain land uses are referred to in Section 3.7. However agriculture also has a significant potential impact on river restoration through fine sediment loadings (see for example Water UK, 2002).

Sediment is an important part of a healthy river system and is an essential component of many aquatic ecosystems. The EC Water Framework Directive requires sediment pressures to be identified and any risks managed for watercourses to meet good ecological status. High silt loadings can lead to accumulations in the channel downstream, causing flooding in urban areas. Excessive sediment can also cause a burden on water companies (which is then passed on to consumers). Conversely, on some river systems, pressures such as bank protection, hydropower schemes and barrages have taken sediment out of the system to the detriment of downstream estuaries where erosion of inter-tidal habitat may occur (rather than the natural process of accretion).

At the current time, intensive agriculture continues to be a key source of diffuse pollution (often from ploughed land) and could increase as a result of climate change. Some funding is available for activities such as buffer strips and fencing through the Catchment Sensitive Farming programme. Potentially because the problem is ubiquitous, significant funds may be needed to support new catchment management measures and structures. Funding streams such as CAP and flood risk management should be re-directed or focused on sustainable activities, rather than unsustainable practices (Water UK, 2002). A robust and flexible mix of policies from regulation through to advice and incentives is needed. The scope for increased Rural Development Programme funding of collective actions should also be explored (see Davies et al., 2004) (see also Section 2.3.6).

Various authors have also suggested the need for a communication and education programme. The Environment Agency of England and Wales for example, produced in 2010 a Sediment Matters Handbook designed to be used by a wide range of non-specialist users to help understand catchment sediment issues. It enables users to understand catchment sediment dynamics, identify sediment-related problems, devise sediment monitoring programmes and collect evidence of sediment related problems. The handbook also focuses on management and restoration for multiple benefits.

There has also been research work in Scotland looking at the potential for local cooperative activities involving farmers in the management of diffuse water pollution amongst other issues (see Davies et al., 2004). Some of the key findings of this work included:

- Farmers prefer to work independently rather than in groups.
- Farmers do not see it as their role to identify environmental benefits.
- Current incentives to encourage collective environmental action amongst farmers are weak.

It was felt unless there is a radical change in the funding structure and farmers' attitudes then catchment initiatives would only come through coordination by Government agencies. Achieving the objectives within the deadlines set by the WFD will require a degree of cooperation and negotiation (at policy and operational

levels) with the agricultural sector which traditionally has very unfamiliar to water managers in many Member States. To be fully effective, interactive Governance is required.

### 3.7.1 Opportunity: Catchment Coordinators (Scotland)

In Scotland a new programme for tackling rural diffuse pollution began in March 2010, to help deliver the objectives outlined in the River Basin Management Plans (RBMPs) for the Scotland and Solway Tweed basins. Diffuse pollution priority catchments were identified by SEPA as catchments failing to meet environmental standards. Fourteen priority catchments, containing some of Scotland's most important waters (for conservation, drinking water, bathing and fishing), were selected using a risk based approach for action in the first basin planning cycle. SEPA appointed dedicated priority catchment coordinators to investigate the issues each catchment faces and to undertake liaison with local land managers to implement the measures. The priority catchment work is also part of the Diffuse Pollution Management Advisory Group (DPMAG) Implementation Plan.

## 3.8 Other Pressures: Hydropower and Tidal Barrages

Many of those questioned for this review identified the threat of hydropower. There is generally a lack of integration between the energy and water protection sectors of Government. Starting at the EU level there are conflicts between the Water Framework Directive and Renewable Energy Directive. Low-head hydropower, for example, presents real conflicts with the water environment. An early WFD goal in many countries is the removal of redundant in-channel structures (e.g. weirs) to improve connectivity and re-naturalise rivers. However financial incentives from Governments can be such that they lead to the retention of in-channel structures. In the UK the Department for Energy and Climate Change (DECC), for example, actively promotes low-head hydropower schemes for a number of houses or a small community by providing a 'feed-in tarrif' (from April 2010) to the national grid (www[19]). Whilst installers must consider issues such as protecting wildlife and fish, DECC announced in April 2008 that household scale microgeneration installations (<50kWs), which have little or no impact beyond the host property, can go ahead as they are eligible for permitted planning.

Hydropower (HEP) involving dams is seen as a key threat in Finland and other North European Countries, with strong opposition to fish passes from energy companies. This is seen as a potential hindrance to restoration projects at a catchment scale intended to allow fish passage to spawning areas in the headwaters of river systems. HEP could help promote WFD objectives by incorporating fish passes. However several of those questioned for this project point out that WFD demands more than just fish passes (which on their own are a very limited form of restoration). Dam construction and water diversion to HEP plants prevent connectivity and cause a deterioration of natural habitats by damming and regulation of flows. Also, more natural fish passes are required for particular species of fish and invertebrates. In Finland, a national fish pass programme has been prepared to evaluate the priorities for connectivity and enhancement of migratory fish populations (Jarvenpaa et al., 2010).

Tidal barrages for the purposes of flood risk management, renewable energy, navigation and/or recreation are also an increasing pressure on river restoration. In the UK, for example, there have been investigations into the Rivers Severn and Mersey (Sustainable Development Commission, 2007). These types of development potentially conflict with other Government policies and strategies, such

as *Making Space for Water* and *Working with Natural Processes.* In the UK such developments would need a multitude of consents: planning permission, land drainage consent and a marine licence etc.

## 3.9 Political and Public Acceptance

There is a fundamental lack of political will to carry out large-scale restoration in many Member States (see Section 3.2 on Policy)

There may also be an assumption that general public acceptance of river restoration should be automatic. However this is far from the case (as demonstrated by several people who were questioned for this review). There may be constraints imposed by pressure groups and cultural attributes (e.g. attitudes). There may be flood defence objections arising from replanting of floodplains with trees and forests (e.g. a perceived or actual risk posed to floods by fallen trees or other woody debris). In many Member States local guidelines still often restrict planting of trees near watercourses. There are also potential conflicts from nature conservation interests; in some situations wooded areas are seen as potentially detrimental to endangered bird species as trees may offer cover for predators. There is often a conflict between those promoting wet grassland versus those who would like to recreate forests. It is important to engage the public early to overcome some of the real or perceived barriers.

An interesting finding from the FLOBAR2 work (www[15]) concerns landscape preferences. In regions where there is no collective memory or evidence of floodplain forests it has proven difficult to communicate the vision of trees on a floodplain as a means of habitat restoration. With notable exceptions from some Member States such as Austria and parts of Germany, many stakeholders view the 'normal' floodplain landscape as being a flat, open space with low vegetation. Ironically this was one of the findings of the River Cole (Wiltshire, UK) EU LIFE Demonstration project. People interviewed had initially preferred an agricultural landscape of an artificially over-deep channel rather than a more naturalised re-meandered channel. On the River Nar (in East Anglia) there is resistance to changing the historic landscape, composed of mills (which are generally listed) which artificially pond water.

## 3.10 Consenting Regimes

Consents and licences are diverse and the resource involvement and formal paperwork required to achieve a restoration project can be very expensive and time consuming. One of the contributors to this review (a practitioner) suggested that "*they can be a pain, but once you have mastered them there is not a significant issue*". There are a variety of consents ranging from planning permission from a local authority and specific consents for flood defence/ land drainage from competent authorities. One example is Waste Management as recreating a more natural floodplain and wetlands can result in significant arisings (spoil) with the need for disposal. Obviously dealing with more complex procedures (such as the Habitats Directive) for managed realignment schemes generates a considerable volume of paperwork.

## 3.11 Evidence Base and Monitoring

An evidence base is important for justifying actions and for example, convincing some landowners what the implications of change might entail now and in the longer term. The lack of empirical evidence was seen as a key issue to progress by a

number of those questioned for this review. This can be a barrier to unlocking significant funds associated with, for example, flood management.

There are an increasing number of robust databases to justify intervention on particular catchments or water bodies etc. For example, in the UK, European Protected Rivers (SACs) have plans compiled by river morphologists and ecologists to identify actions required to bring a river to favourable condition. Priorities have been identified in the Eden, Derwent and Kent catchments in Cumbria, on the River Kennett (in south central England) and the River Wensum in East Anglia.

*The ecosystems we manage and restore are complex systems that often have non-linear and unpredictable behaviour. Our understanding of how systems work under current conditions is often rudimentary, and we often have to learn as we go* (Harris et al., 2006)". Lack of a technical evidence base to support managed realignments and floodplain restoration, for example, should improve as the body of casework increases (Ledoux et al (2005)). However the larger the scale of a project, the more complex the interactions and the greater the magnitude and extent of scientific uncertainty. "

The Environment Agency (2008) produced a report concerning the state of the evidence base of pressure-impact relationships for sediment and hydromorphological pressures impacting aquatic ecosystem health and function. It formed part of the first stage of work in a larger project 'Managing Hydromorphological Pressures in Rivers'. The key driver for this work was implementation of the WFD which required evidence that the 'ecological status' or 'ecological potential' of surface water bodies had improved. This is a pan-European issue. It was concluded that there is a considerable evidence base (which continues to grow). However, most papers published over the past 80 years, or so, are concerned with qualitative studies that have limited baseline data and generally describe static patterns rather than temporal variation. Studies examining dynamics and process rates are extremely rare and yet these are needed for improved understanding of hydromorphological pressures and prediction of their potential impacts. Specific gaps in knowledge outlined in this 2008 report relate to aspects of lateral connectivity, scale issues, temporal variability and combined effects. The report also identified that a fundamental obstacle to progress is the general lack of true integration (i.e. interdisciplinary work). For example there are many papers (the majority concerned with conceptual models) produced in the last decade, or so, that are framed in multi-disciplinary terms. However these have generally failed to integrate geomorphology and/or hydrology with ecology. There is a need to improve the link between hydromorphological criteria and ecology at an individual project level (i.e. assembling an adequate team to solve a management issue such as design of mitigation). Whilst there are some exceptions, generally research programmes in Universities in the UK remain embedded in the individual disciplines and are not truly integrated (Environment Agency, 2008).

With specific reference to floodplain restoration, there appears to be considerable uncertainty. One of the contributors to this review suggested that from a fish spawning perspective it may only be effective to restore particular zones in a catchment. Similarly it may also be necessary to focus on particular parts of the floodplain to maximise ecological recovery.

Uncertainty also exists in terms of the potential impacts of climate change (nationally, regionally and locally). Harris et al (2006) suggest that rather than respecting historical 'pre-disturbance' conditions to reset ecological processes, then

more realistic and meaningful objectives need to be set for future restoration projects.

*"To this complexity and lack of understanding, we now have to add the fact that environments are changing, and the rate of change is unprecedented. The past is no longer a prescriptive guide for what might happen in the future……..a key question for everyone involved in restoration is the proper balance between rebuilding past systems and attempting to build resilient systems for the future….."*(Harris et al., 2006).

One of the key challenges is that from a morphological perspective alone there are many hundreds of different river types throughout Europe, ranging from high energy Alpine river systems that might potentially recover from channel straightening in the absence of maintenance, to lowland clay rivers that cannot change their courses perceptibly and even ephemeral systems. Even at the basic level of a river divided into upland, piedmont, lowland and estuarine reaches, there is a dearth of scientific evidence of how the river will respond to restoration and what the benefits would be.

Pullin et al (2009) suggest that a key challenge at the science-policy interface is to identify research questions underlying these problem areas so that conservation science can provide evidence to underpin future policy development (see next Section, 3.13). They demonstrate that top policy issues in Europe need to be informed by high-quality conservation science. There has been little evidence of comprehensive and long-term monitoring in the past, not least because of the very considerable costs of collecting data over wide spatial and temporal scales. Given the very tight timescale for WFD implementation, it is important that monitoring and learning are undertaken as part of real 'live' projects (Environment Agency, 2008). 'Standard monitoring protocols', currently being developed, are one way forward, ensuring that at least some information about pressure-impact relationships is collected with each development opportunity. The timing of these projects are also important if the monitoring results are to feed into the RBMP 6 year cycle (2015, 2021, 2027).

## 3.12 Capacity Building

The task of restoring rivers and catchments are complex and represent some of the most difficult challenges faced by natural resource scientists and managers today (see for example Ryan and Jensen, 2008). The lack of science-policy integration has been described as a 'missing link' for the WFD (Quevauviller et al., 2005). Both scientists and policy makers have been blamed for the inability of Society to deal adequately with the challenges posed by restoration. There are particular factions of academia and Government Regulatory bodies who argue that we must be precautionary as there is an inadequate evidence base (see previous section, Environment Agency, 2008). There are others who argue that is actually the lack of political will and leadership that acts as a barrier to progress. Whatever the root cause, it is the science-policy-operational practice interface that is of interest in moving forward. It is arguably the lack of effective communication between these different functions that has helped hinder the development, selection and implementation of more holistic and integrated forms of restoration.

Several ways have been suggested for overcoming such barriers and constraints (e.g. Ryan and Jensen, 2008). However one key mechanism is capacity building. Specifically this means communicating the existing knowledge base to practitioners, policy makers and scientists. Expert networks can assist with the process of capacity building and improving knowledge management. Such networks can be

used to exchange information and rapidly disseminate new findings and results which may be of interest to different types of stakeholder. It is a mechanism by which science and robust data can be used to underpin policy development and implementation.

### 3.12.1 Opportunity: River Restoration Networks

The European Centre for River Restoration (ECRR, www.ecrr.org), the Italian River Restoration Centre (CIRF, www.cirf.org) and the River Restoration Centre in the UK (www.therrc.co.uk) are all well placed to assist with dissemination of science and information to key stakeholders (whether they be practitioners, policy makers or local groups such as Civic Trusts etc). This network is proposed (through this RESTORE project) to build the capacity of regional Non-Government Organisations (NGOs) and to facilitate the development of partnerships. It will play a key role in delivering information to relevant stakeholders in a timely fashion so that policy and practices on the ground can be successfully developed.

## 3.13 Social Issues

Flitcroft et al (2010), albeit based on USA experience, highlight the importance of trust (i.e relationships) as a key element in successful catchment management. Their premise is that trust is required to build a catchment restoration 'organisation'. Several academics advocate that further social science research is needed in planning research (see Moss and Monstadt, 2008). This is said to be required to understand the multi-faceted institutional context and overcome the strong barriers to restoration (Potter, 2008). Challenges for delivery (after RELU, 2010) include potential conflicts between multiple national policies and national policies that take little account of local variations. To overcome some of these issues, RELU propose wider stakeholder involvement; early identification of local issues; building existing networks and relationships.

In the UK there have been several small studies looking at social issues in relation to social issues. These are predominantly on London Rivers such as the Mayesbrook (see Section 4) and the River Quaggy (see www[20]). The Mayesbrook looked at how different Sectors of Society can be engaged to develop river restoration plan visions. There has also been work looking at the social and health benefits of restoring rivers, particularly in urban areas.

However several practitioners who contributed to this review state that this is not a priority (at least for the UK). It was stated that "*we need to learn as we go*". There is a feeling that in Government Agencies at least there is now adequate capacity for building relationships and facilitating meetings and workshops, leading to successful outcomes.

## 3.14 Dealing with Barriers in the Short and Long-term

In summary, there are several mechanisms for dealing with barriers over the short-term:

- Grouping and using policy instruments together.
- Effective participation reducing the severity of institutional and political barriers and by encouraging joint action to overcome them.
- Adopting effective approaches to implementation (thereby reducing the severity of many barriers).

Taking a longer-term view (say a 15 to 20 year timeframe), then it is possible that many of the current barriers will no longer apply in the future. It is likely in that timeframe that revisions to legislation will have been made. New and more effective institutional structures in Member States may have been put in place. Also, a key element in any strategy should be the identification of ways of resolving these longer term barriers.

## 3.15 Over-riding Opportunity: Stakeholder Partnerships

Gilvear et al (2010) made an assertion that unless there is a fundamental paradigm shift, a change in the nature and level of funding for river restoration and a single organisation is given overall responsibility to direct river restoration then 'business as usual' will prevail and the benefits of catchment scale restoration will be limited. There is a need to develop trust and a common vision for the aims of restoration programme. An intermediary stakeholder-led organisation can be a useful vehicle to overcome barriers provided by farmers and landowners. Working in partnership is integral to the successful delivery of river restoration. Successful partnerships encompass the full range of stakeholders including landowners, local authorities, regulatory bodies to local users and community groups.

The broad scope of the WFD for example, means that many organisational and individual stakeholders need to be involved in implementation. Each of these interests has different objectives, levels of understanding and perspectives. This could be regarded as potentially overwhelming. So engagement should be targeted in terms of resource and timescale and needs to be practicable. The WFD provides the opportunity for many different types of interest to be engaged in restoration.

Coordination skills are therefore a key part of project management. In the UK and Ireland a number of Rivers Trusts have been established to promote and deliver catchment and river improvements. There were 34 Trusts in 2009, but new trusts continue to be formed. Trusts are independent charitable organisations which work for the public benefit (www[21]). Trusts generally apply for public funding to enable river enhancement and restoration projects to be undertaken. They have become experienced in marrying the needs of a river or catchment with funding criteria and while this often requires compromise it encourages partnership working and a desire to find sustainable solutions.

In the UK, major landowners are becoming increasingly aware of their responsibly for protecting and conserving the environment. There are some good examples were a single landowner has allowed large-scale restoration to progress (e.g. Knepp Castle in Sussex). The National Trust, which owns 254,000 hectares of countryside in England and Wales, recognises the critical importance of cooperation when developing catchment management initiatives (www[21]). The Trust is actively promoting the restoration of wetlands and natural river systems. In Cumbria, England, the National Trust as a major land owner has promoted the establishment of a number of informal catchment management groups with the objective of developing sustainable approaches to catchment management. These groups, which are community focused, are designed to facilitate cooperation between regulatory bodies, landowners, land tenants/managers and local users. The EU LIFE Demonstration Project for the River Cole in Wiltshire was carried out on National Trust Property in the 1990's . Other examples of National Trust projects are Sinderland Brook in Manchester and Blenheim Palace in Oxfordshire. There is also a scheme aimed at allowing managed retreat of a flood embankment on the River Dee (Mar Lodge) on National Trust for Scotland land. National Trust and National Trust for Scotland property can be a 'line of lesser resistance' for restoration projects

as it is land held indefinitely in a trust for future generations. Arguably also many projects in urban areas have been completed in public parks in the ownership of a single local authority (see for example the London Rivers Action Plan).

United Utilities (UU), a major UK water company, owns 58,000 hectares of land in north west England to protect the quality of water entering the reservoirs. The company has developed a Sustainable Catchment Management Programme (SCaMP) in association with the Royal Society for the Protection of Birds (RSPB). The objective of this initiative is to apply an integrated approach to catchment management in two key areas of United Utilities land, Bowland and the Peak District area. This aims to deliver Government targets for SSSIs (30% of UU land in designated as a SSSI), enhance biodiversity, ensure a sustainable future for the company's agricultural tenants and protect and improve water quality (www[22]). This is also a key project in that it demonstrates the link between restoration of an upland (e.g. bogs and mires) and wider catchment benefits (e.g. flood flow attenuation and improved water quality)

At another level there is a need to strengthen cooperation between nature and water authorities to maximise the benefits of WFD and BHD implementation (Section 3.2). There are good examples (again from the Netherlands) of Government-led partnerships.

### 3.15.1 Residual Issues

There are several residual issues concerning stakeholder partnerships. Several contributors to this review believe that such partnerships need to be led from the centre (i.e. a competent Government organisation). In the UK, for example, the 'Big Society' is a broad vision that crosses a range of public services, whereby Government and centralised decision-making will be reduced and communities 'empowered'. For planning, the Big Society has come to be defined by 'localism' (and in 2010 a Localism Bill was launched). How localism will fit with the need for a restoration strategy (for a catchment) is yet to be determined.

Again in the UK there are some excellent success stories of existing Rivers Trusts (e.g. Eden, Tyne, Tamar and Tweed, all with established websites) (www[23]). Some have found alternative sources of funding such as Heritage Lottery grants. However in terms of newly emerging Rivers Trusts, a number of those consulted for this review suggested that one of the biggest challenge will be capacity building. Capacity development is the process by which individuals, organisations and institutions develop, individually and collectively, to perform functions to solve problems and achieve objectives. A key issue is the need to provide advice and training (e.g. Codes of Good Agricultural Practice; nutrient management plans, and Catchment Sensitive Farming Delivery Initiatives).

A related issue is that building a partnership (particularly for the more complex and larger scale restoration initiatives) could take significant effort and time being required in planning and to engage with landowners and local communities prior to implementation. It can take a long time to build trust. There is also the risk of projects being abandoned, perhaps after a few years into a venture because of the opposition of a single landowner.

## 3.16 Emerging Opportunities

There are a huge number of initiatives emerging in Europe which might lead to shifts in policy and/or practice, not least this EU LIFE RESTORE project. It is not possible to list all here but as a flavour the following are exciting examples specifically from the UK.

### 3.16.1 The Natural Environment White Paper

The Natural Environment White Paper of June 2011 will need to create a new policy framework to drive nature's recovery, building on existing statutory protections. The Wildlife Trusts believe that England needs a new Nature Act to create the necessary impetus for significant restoration of habitats and ecological processes on a landscape scale. In particular, the White Paper should lay the foundations for the establishment of ecological restoration zones across England and new Local Nature Partnerships to help drive this process. The key functions of Local Nature Partnerships will be to:

- Identify zones for ecological restoration through enhancing existing landscapes and national and local wildlife sites, taking action for priority species, restoring the processes that drive ecosystem health and restoring and creating new areas of habitat.
- Integrate land management policies, incentives and decision-making locally to ensure efficient use of resources and the provision of key ecosystem services such as clean water, food, flood protection and control of our climate.
- Work with local authorities to identify ecological networks as part of the Local Plan, including zones for restoration.

### 3.16.2 Strategic FRM at the Catchment Scale

The driving policy document of a Strategic Flood Risk Assessment (SFRA) is Planning Policy Statement 25: Development and Flood Risk (PPS25). This SFRA will inform land allocations, development control policies, and sustainability appraisals and will be carried out in liaison with the Environment Agency (EA). The overall aim is to guide development to locations with the lowest risk of flooding using a sequential approach. The sequential test assesses development within the three flood zones, (which are delineated by the Environment Agency) and localised drainage issues.

### 3.16.3 Demonstration Test Catchments

There are now a number of demonstration test catchments (DTCs) (see also Appendix B) for developing a large-scale research platform for which restoration techniques are or will be applied. Ten test catchments have been selected to test measures for reducing diffuse pollution from agriculture (2010-2014). They consider impacts and effects on both ecosystems and sustainable production. These DTCs include the Hampshire Avon (a Catchment Sensitive Farming area), the Eden in Cumbria and the River Wensum. These catchments were selected for their variable geographical, geological, climate and agricultural land use. Investigations are being carried out into the efficacy of diffuse pollution mitigation measures, including examining a spectrum of intervention intensity, including the use of constructed wetlands, agri-environment measures in ELS together with some carefully targeted additional options and water company-funded payment for ecosystem services. The planning of mitigation measures is mindful of the source-mobilisation-delivery-impact

diffuse pollution continuum and the need to support the agricultural sector with respect to critical business considerations. Ultimately the integrated toolkit will be tested and revised using 'communities of practice' focused on helping to develop bottom-up river catchment management as part of the 'big society' initiative launched by the coalition Government. The network may be expanded further as more Government money is made available.

### 3.16.4 Strategic Planning

Providing a mechanism for strategic planning of restoration measures is a key opportunity moving forward. The reason for strategic planning is that the problems are not always obvious and the solutions are far from simple. A good plan is therefore crucial. A transparent planning procedure ensures some public accountability. Planning helps in discerning between the obvious/visible problems at a site and focusing more on the catchment context problems and issues. Priority setting avoids focussing on the symptoms rather than causes; i.e. it can allow the more important issues to be teased out rather than the ones that appear superficially important. Planning also allows a staged approach, perhaps using a number of years worth of funding. Arguably it would perhaps not be unreasonable to spend 5-10% of a projects' cost on planning.

In most Member States the River Basin Management Plans (RBMP's) are regarded as the primary vehicle for identifying and prioritising measures. SEPA manage the Scotland's Water Environment Restoration Fund at a strategic level across the country, and welcome applications from projects that contribute to the WFD objectives, as set out in Scotland's RBMPs and tackle physical pressures affecting the water environment. Ideally, the project should also deliver wider environmental, social and economic benefits (see also Section 3.3).

However several individuals questioned for this review expressed a view that RBMPs in some countries can be too generic and divorced from practical issues on the ground in a catchment. RBMP districts are regarded by some as too large and are not homogenous because of the different characteristics of their constituent catchments. RBMPs can lack ambition and do not have clearly stated objectives that could lead to achievement of good ecological status in a structured and progressive way. The Annexes of plans are often based on inadequate data and contain numerous errors. Several have therefore called for a more specific catchment tool to screen proposals and allocate funds. In the UK these have been termed 'Catchment Action Plans'.

A good example of an existing tool is that used by Natural England in England. The first 'whole river' restoration strategy to be prepared in the UK was for the River Wensum, a river designated for nature conservation reasons (Natural England, 2009). It is based on a desk study and walkover survey (geomorphological and ecological) of the entire catchment. The resultant strategy helps Natural England to:

- Develop a standard approach to river restoration that is accepted and understood by key partners, such as the Environment Agency, and stakeholders, including riparian landowners and fisheries managers.
- Apply sound science and surveys to ensure rivers are successfully restored.

Natural England has used the findings in the report to:

- Identify and prioritise physical restoration measures on the River Wensum SAC that will help to achieve its conservation objectives in the most cost-effective way.
- Develop and test a methodology for producing a restoration strategy on a whole-river basis that can be applied more widely to other river SSSIs.

This method has been applied to other SSSI and SAC Rivers but it is relatively expensive because it entails a considerable amount of fieldwork.

An opportunity may be to pioneer less expensive alternatives that can offer a catchment-based approach to WFD, including optimising engagement with partners. For example Government bodies in the UK may be able to work with Rivers Trusts to help deliver WFD. According to two questioned for this review, there is an imperative to develop a catchment-scale approach so that the newly established Catchment Restoration Fund in England can be expended on technically feasible proposals that ensure cost-effective use of public funds. In practice, there could be competing proposals for funding within a single catchment.

At the largest scale, the best example of strategic planning of river restoration (for the WFD) is that of the Danube River Basin. The coordinating body is the International Commission for the Protection of the Danube River (ICPDR) (www[24]). The Danube covers about 9% of Europe and flows through 19 Countries. A legal framework was signed in June 1994 for the protection of water and ecological resources and with the advent of the WFD in 2000, it was made the highest priority for the ICPDR. In terms of hydromorphological alterations, a basin-wide vision exists. This attempts to balance management of past, ongoing and future structural change of the riverine environment such that the aquatic system functions in a holistic way. Thus for sturgeon and other migratory species, more than 219 barriers have been made passable for fish. The remaining 693 barriers will be addressed by 2021/2027. Some 578,115 ha of wetlands/ floodplains with reconnection potential were identified. The strategy is that 60,450 ha will be reconnected and/or the hydrological regime improved by 2015. Some examples of Restoration on the Danube are given in Section 4 and Appendix B.

# 4 Good Practice Project Examples

## 4.1 Introduction

There are existing reviews of good practice projects involving both floodplain and catchment restoration (Bannister et al, 2005; Moss and Monstadt, 2008; Wise Use of Floodplains (www[14]); EU LIFE, 2010) in various Member States. These are reviews involving more complex projects (with multiple benefits) than the more traditional single site specific examples. The following examples are divided into UK (Section 4.2) and Europe (Section 4.3). A more comprehensive list of projects (again specifically selected to illustrate this review) are provided in Appendix B and listed in Table 4.1. It is appreciated that there are many other EU LIFE (and other funded) projects than are covered here, but this section and Appendix B help to illustrate a range of examples of good practice across Europe.

**Table 4.1 Example projects (see Appendix B for more detail)**

| PROJECT NAME | COUNTRY |
|---|---|
| **FLOODPLAIN** | |
| The Forth Catchment Project | United Kingdom |
| Somerset Levels and Moors Project | United Kingdom |
| Fens Floodplain Project | United Kingdom |
| Erne Sustainable Wetlands | Ireland |
| **CATCHMENT** | |
| The Tarland Catchment Initiative | United Kingdom |
| Restoration of the Hampshire Avon | United Kingdom |
| Hampshire Avon Demonstration Test Catchment (DTC) | United Kingdom |
| Tamar 2000 Support Project | United Kingdom |
| Cornwall River Project | United Kingdom |
| Cree Valley Catchment | United Kingdom |
| Mersey Basin Campaign | United Kingdom |
| Sustainable Management of Urban Rivers and Floodplains (SMURF) | United Kingdom |
| New Forest Streams | United Kingdom |
| Restoring the natural dynamics of a Danube floodplain | Austria |
| Boreal river basins – A cost-effective decision support system for management of boreal river basins | Finland |
| Institutional issues with implementation of Floods Directive in Bavaria | Germany |
| River Boyne | Ireland |
| “Contrat de Rivière” as participative decision making tool to implement River Restoration. | Italy |
| Guadajoz River basin | Spain |

## 4.2 UK Examples

### 4.2.1 Recognition of Climate Change

**Mayesbrook Climate Change Park, Barking, East London, UK**

This is the €1.1 million first phase of a project to transform a rundown 45 ha urban park into a showcase of how public greenspace can help a community to cope with the risks from climate change such as increased flooding and higher summer

temperatures. This restoration scheme was designed between 2008 and 2010 and the work began to be implemented in March 2011 (with an anticipated completion date at the end of 2012). The works involve breaking Mayesbrook out a concrete channel over a length of 1.6 km, thereby improving wildlife and recreational value. The water body currently fails to achieve good ecological status. A new one-hectare floodplain will be excavated along side the brook to safely store anticipated future increased floodwaters. In addition, separate Thames Water work to remedy misconnected drains will help improve water quality. Trees will be planted over an area equivalent to three football pitches to provide shade. New recreational facilities will be created such as footpaths. Phase 2 (2012-2014 and beyond) is proposed to involve construction of a new café, surrounded by drought resistant plants. Two nearby recreational lakes will also be cleaned up.

Key ways in which the project overcame some of the potential barriers to such projects:

- *Innovative partnership of public, private and voluntary organisations.* This included the Thames Rivers Restoration Trust (TRRT), London Borough of Barking and Dagenham, Environment Agency, Greater London Authority, London Wildlife Trust, Natural England, Design for London, Royal Sun Alliance Insurance Company and the SITA Trust. TRRT facilitated putting together the innovative partnership in 2008.
- *Multiple sources of funds.* No one organisation could afford to create such a multi-purpose Climate Change Park. A private Insurance Company donated €345,000; the Mayor of London gave €460,000. Natural England and the Environment Agency also provided funding.
- *Non-complex land ownership.* It is an urban park in the ownership of one local authority.
- *Climate change awareness.* Although similar to projects in other urban parks in London, this project specifically broadcasts the need to plan for climate change.
- *Value for money.* Improving and future proofing all aspects of the park in one contract, thereby attracting competitive bids to undertake the work.
- *Community participation.* Involving displays, leaflets and public meetings.
- *Payment for Environmental Services.* A calculation made by the Environment Agency estimates that the project will bring up to seven times the €4.6 million cost over the next forty years. Most of these benefits will be in health, recreation and tourism.

Residual issues:

- The length of brook affected is still a relatively small length (1.6 km) of the water body. However this project demonstrates that partnership working is essential to meeting the objectives of the WFD. The initiative is part of the London Rivers Action Plan which aims to restore more than 15 km of river by 2015.

## 4.3 European Examples

### 4.3.1 Reconnection of Floodplain and River

**Dijle valley (Dijlevallei), Leuven, Belgium**

This is a EU LIFE Project (LIFE98/NAT/B/005171) which had the objective of restoring the natural flood retention capacity of the area as well as reconnecting the

river and floodplain allowing restoration of alluvial habitats (www[14]). The town of Leuven downstream suffered from flooding. This provided an alternative solution to a potentially damaging flood retention reservoir in the area and provided a win-win result for natural conservation and flood risk management. Natural grassland habitats were created in place of poplar trees and maize crops. It was completed between 1998 and 2001 (at a cost of €845,000) and has become a demonstration project for possible future projects across Europe.

Key ways in which the project overcame some of the potential barriers to such projects:

- *Purchase of land.* Whilst a conservation NGO already owned land in the affected area, as a first priority nearly 55 ha of additional land was purchased by a conservation NGO using in part EU LIFE-Nature funding. An additional circa 55 ha was acquired by other Belgian Government organisations including the competent authority for river catchments (undertaking hydrologic engineering works).
- *Multiple objectives.* Natural flood control and extension on farmland of species rich grassland habitats (already protected as part of an established nature reserve by the Habitats and Birds Directives). There was also a need to improve the water quality of the river (WFD) and a number of other EU legislation requirements
- *Compensation.* Provision was made to compensate some farmers. In several cases land bought from farmers is now leased back to them free of charge solely for the purpose of grazing. Farmers market the meat locally at a premium price as it is labelled 'nature meat'.
- *Local resistance.* Proven to be a cheaper solution than large flood retention reservoirs. A management plan has been produced.

Residual issues:

- It is still a demonstration project. So relatively small example extending over a length of 4 km and width of 1 km.

**Extensive planting of floodplain forest, River Elbe, Lenzen, Germany**

This is a German example, involving the relocation of a dyke on the Elbe in the federal state of Brandenburg (Monstadt, 2008). It involves the restoration of 420 ha of floodplain area by relocating a dyke. Dyke construction started in autumn 2005. This project envisioned a complex programme of measures for ecological restoration, including extensive planting of trees. It brought to the fore the potentially high costs of such projects. It also aims to achieve flood protection.

Key ways in which obstacles were overcome:

- Complex funding structures identified and varied sources of funding sought.
- Designed to meet multiple objectives, benefiting flood risk management, nature conservation and agriculture etc
- Use of a 'core network' to manage the project.
- Effective stakeholder engagement (using tools such as exhibitions and facilitated meetings).
- Use of rural development initiatives.
- Use of land consolidation procedures.

Residual issues:

- These types of project are very costly (an alternative of 'letting nature do its own thing' was suggested).
- Inability to 'think catchment' whilst promoting a floodplain restoration project.
- Calls for a new river basin management agency (to effectively integrate flood risk management and nature conservation).

**Reconnection of main Channel with floodplain, Vienna, Austria**

Austria is providing some excellent examples of reconnecting the channel with the floodplain and therefore has wider applicability. This case study describes a project completed in 1997 for rehabilitating a section of the Danube within Vienna. The completed project concerns improvement to the shoreline of part of the Danube through Vienna, severely impacted by historical channel straightening, regulation (HEP) and urban development. The rehabilitation involves new artificial side channels, embayments and gravel banks and pools (Chovanec et al, 2002). The main elements include man-made inshore structures along the left bank of the 21 km long Danube Island in Vienna. The key ecological objective was to improve the corridor function through the municipal area of Vienna.

This is an important project because of the emphasis it places on monitoring. The project was completed in 1997 and in 1998 a large monitoring study was commenced (Chovanec et al, 2000; Chovanec et al, 2002). The first two years of monitoring showed that new migration linkages were used by amphibians and dragonflies colonising the new habitats, particularly in the southern parts of the islands (ponds, riparian wetland areas and the floodplain more generally). The data for rheophilic fish species showed that the new embayments and side channels were important as macroscale migration corridors. Fish species richness increased with connectivity.

There are other projects in Austria concerned with lateral connectivity. There is a planned project concerning one of the last free-flowing reaches of the Danube between Vienna and the Austrian-Slovak border. It has a navigation function but also most of the region is part of the National Park Donau Auen. A project was carried out by the Austrian Ministry for Transport, Innovation and Technology (BMVIT) and the ViaDonau with three main objectives: i) to reduce river bed erosion; ii) improve navigation conditions (particularly during low conditions) and iii) improve the ecological function. The overall aim is to improve ecological conditions by riparian restoration measures and the reconnection of side channels. Initially the measures are to be applied to a 3 km test reach, before being extended to a total length of 40 km. An end date for construction is proposed as 2017. To ensure the effectiveness of the measures, a comprehensive monitoring plan has been devised.

**Lower Danube**

The Lower Danube was subject to a Green Corridor Declaration (Lower Danube Green Corridor) in 2000 (www[24]). The signatories are Bulgaria, Moldova, Romania and the Ukraine. Some 84% of the floodplain (out of a total of 514,000 ha) located mainly in Romania had been drained between 1960 and 1990, with considerable lengths of embankments, significantly limiting lateral connectivity. The Declaration includes for the restoration of more than 225,000 ha of floodplain/ wetlands. After Romania and Bulgaria joined the EU in 2007 the process of designation of protected sites speeded up. By the end of 2008 some 46,900 ha had been reconnected to the Danube river system. Some 15,000 ha of wetlands had been restored in Romania.

This is less than the objective set in the 2000 Declaration, mainly because of agricultural land use constraints and also navigation on the Danube. Another notable project is one in Bulgaria (Belene Island, Kalimok marshes). This project involves restoration of former floodplain forests and wetlands. The value of wetland benefits has been calculated as €500 per ha per year.

### 4.3.2 Change of an Agricultural Landscape

**River Skjern, Western Jutland, Denmark**

This project has involved the recreation of wetland habitats (4000 ha) at the mouth of the river, including meadows, reed swamps, meandering watercourses and shallow lakes (important for various species including migratory birds) (see Pedersen et al., 2007). These habitats were initially replaced by arable crops following land drainage in the 1960's. However despite large amounts of fertiliser application, the quality of the soil deteriorated such that crop yields fell and the land became marginal. The Danish Government launched a strategy in 1987 to renaturalise some marginal lands and replace them with more sustainable land uses such as grazing and recreational activities. A specific objective was the reduction of nutrient loadings to the sea. The project on the Skerne was implemented by the National Forest and Nature Agency, with the aim of restoring 875 ha of the river valley and re-introducing grazing to over 1600 ha of land. The project was undertaken between 2001 and 2004 at a total cost of €7.4 million (with a €2.2 million contribution from EU LIFE). The river was re-meandered over a distance of 20 kms, allowing reconnection with the floodplain and approximately 1200 ha of grasslands were established. The site became designated under the Habitats Directive in 2006.

Key ways in which the project overcame some of the potential barriers to such projects:

- *Exchange of land.* As with previous schemes in Denmark, land was bought elsewhere in the location to allow a 'land swamp' for some affected farmers.
- *Land regarded as poor for crop production.* This made the change to grazing of grasslands easier.
- *Monitoring implemented.* This was partly instigated to ensure that there were no adverse impacts on adjacent landowners such as increased flood risk. However other elements of the monitoring programme were effects on nutrient transport and retention, river morphology and habitats for macro-invertebrates, fish and macrophytes, vegetation on the floodplain, amphibians, otter and migratory and breeding birds (1999-2003). A management plan exists for the site for the period 2005 to 2020.

**Change of floodplain land use in Aragon River Basin in Navarra, Spain.**

Regulation of the Aragón river has led to degradation of the channel and floodplain functions and features and increased flood risk downstream through the construction of dykes. This project aims to:

- Remove or set back all existing dykes.
- Restore the continuous natural riparian vegetation strip (at least 25m wide).
- Restore appropriate land use on the floodplain and ensure that the more intensive agricultural crops, farms, urbanisation and infrastructure is outwith the river space (defined as the 1 in 5 year flood zone).

The project is ongoing and will be for some years as land use changes take time. To date, projects to restore the natural riparian zone has been implemented and dyke removal planned for 2012.

*Community support*: The changes are hoping to be implemented on a voluntary basis. Agreements with owners are currently being developed with aid given by public bodies helping to motivate the changes.

*Multiple benefits*: Floodplain connectivity will be restored, reducing the flood risk downstream. The land adjacent to the river will have greater productivity (with a more appropriate land use). Riparian vegetation will reduce fine sediment supply, improving water quality. Hydrological and morphological elements will also improve, and these together with the other benefits will help to achieve the WFD overall objective of good ecological status.

*Knowledge gaps*: Implementation of environmental agreements or contracts with owners or stakeholders to promote land use changes.

### 4.3.3 Strategic - Catchment Initiative

**The Houting Project, Denmark**

The Houting Project is the largest nature restoration initiative in Denmark (Hansen, 2010). The aim of the project is to ensure the long-term survival of the fish called the Houting, which only lives in the Danish sector of the Wadden Sea. The entire population of Houting in Denmark is estimated to about 7000 spawners. As such, the Houting has been designated as a special priority species in the EC Habitat Directive meaning Denmark has a duty to protect the species and improve its survival. The objective of the Houting Project is to totally restore the habitat of the Houting by removing obstacles (such as weirs), creating new spawning grounds and nursery areas. The project is being supported by EU LIFE funding which is providing €8 million of a total budget of €13.4 million.

The project, which will restore four Danish rivers, involves a strategic/ catchment-wide approach encompassing:

- Removing 13 obstacles to fish migration.
- Enabling access to 130 km of new river habitats.
- Eliminating mortality of drifting fry around fish farms.
- Creating new spawning grounds.
- Restoring approximately 30 km river.
- Creating 500 ha new nursery areas.

Barriers were overcome by successful cooperation between stakeholders including local and regional authorities, land and fish farm owners, a regional angling society, and owners of weirs and other instream obstructions.

**HEALFISH - Healthy fish stocks - indicators of successful river basin management, Estonia and Finland**

HEALFISH is a joint Estonian-Finnish project. Rivers in Finland have been historically heavily modified, whereas in Estonia, the rivers are considered to be closer to their natural state. The aim of the project is to encourage salmonids (such as trout and salmon) to migrate and spawning in the wild conditions. The presence of healthy, self-sustaining salmonid stocks, as well as lampreys is an excellent

indicator of good conditions in a river environment. However, a good salmonid river must be free of obstruction and obstacles for migration to occur. There also needs to be enough spawning and nursery areas, and the rivers must be free of silt and other suspended solids.

The project is intended to demonstrate best practice of river catchment management and river restoration, taking the whole catchment area into account. Funding is received from the EU Central Baltic IVA Program 2007-2013, with a total budget of €1 367 710. The project includes a training program to inform the experts who are planning the restoration measures, as well as those carrying out the actual construction work.

The project started in autumn 2010 and is intended to last for three years. From the Finnish side there are five remediated areas. On the Estonian side, river restoration and rehabilitation planning is done within six river catchments.

The project also complements existing DNA tests within the Finnish Gulf area relating to brown trout and salmon populations. Information can be used to focus on the most original, genetically diverse salmon stocks in the protection of reproductive opportunities.

The project partners are the Finnish Uusimaa Economy, Transport and Environment (EUA-central), South-central Finland ELY, Southwest Finland Centre, Game and Fisheries Research Institute, Finnish Environment Institute and the Association of Pro Vantaa River, and University of Tartu.

### 4.3.4 Evidence of integration of flood risk management and spatial planning

**La Bassee project, France**

The La Bassee project is designed primarily to minimise the risk of severe flooding of Paris (Hagemeir and Klaphake (2008). The planned scheme involves the creation of a controlled polder area of approximately 2500 ha on the Seine River approximately 70 km upstream of Paris. It is an example of a large-scale, inter-regional solution for better flood protection meeting the needs of a variety of stakeholder groups. The main aim of the project is to reduce annual damages from flooding by an estimated €29 million. It is a large project with institutional complexity.

Key ways in which the project overcame potential barriers:

- Effective use of communication vehicles including a project committee and working groups leading to considerable transparency in decision-making.
- Local opposition has been minimised by embedding the flood defence measures into a broader programme of regional economic development and bio-diversity enhancement, creating the prospect of multiple benefits for the affected region (Moss, 2007).
- In contrast to most flood defence works in France, there is wide recognition by those involved of the need for a mechanism of inter-regional compensation for the affected region by the downstream beneficiaries.

Residual issues include:

- Involvement of local municipalities still appears weak.
- There is still a need for effective reconciliation of environmental and flood defence targets.

- Lack of engagement of the Water Agency (a key body) which could hinder implementation.
- Conflict between those who believe in compensation for landowners vs those who believe enforced action should be taken.

# 5 Conclusion

As with all legislation and policies, there are a number of barriers and constraints to implementation. It is therefore not surprising that most efforts to date have resulted in relatively limited examples of floodplain and/or catchment restoration (as well as continued efforts on the more traditional small-scale site type projects). In several Member States including several Mediterranean Countries, there has been political opposition to progress and a limited desire or mechanism to raise the requisite funding.

The Water Framework Directive, as an example, has driven many projects which are easier to construct, for example the removal or modification of physical barriers such as weirs to allow fish passage or installing buffer strips and fences to prevent fine silt from entering a watercourse. The larger the scale of a project then the more complex it is in terms of technology, environmental impact, social processes and economics and finance.

Perhaps the most evident barrier still surrounds the acquisition of land (or rights to change land use). Without alternative mechanisms such as the land bank-type initiatives evident in the Netherlands or Denmark, then holistic solutions perhaps encompassing multiple benefits such as flood control and nature conservation may remain limited pan-Europe. However there is much that can be learned from practice in individual Member States.

A key potential barrier is the lack of interpretation of EU and national policy at the local level where implementation occurs. Decision-making processes are not conventional for a large scale restoration projects, rather it is a case of 'learning as we go'. This review has provided a selection of examples where shear effort and perseverance from individuals or individual organisations, linked to collaboration with stakeholders, has led to barriers being overcome. Improved awareness of issues and problem-solving is driving the field of river restoration forward. Good examples of coordination within river catchments have been set by some of the Rivers Trusts in the UK for example. Whatever policy shifts emerge in the future it is likely that holistic, integrated large-scale projects will remain difficult to implement. However there is cause for optimism, particularly if good practice examples are made available to learn from to other Member States (e.g. through the EU LIFE programme).

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http://www.avondtc.org.uk/
(Checked 24 May 2011)

www[29]
http://www.cornwallriversproject.org.uk
(Checked 24 May 2011)

www[30]
http://www.merseybasin.org.uk/
(Checked 24 May 2011)

www[31]
http://www.iiinstitute.nl/referencecases/rc-munich-isar-plan-munich
(Checked 24 May 2011)

www[32]
http://www.ecrr.org/archive/conf08/pdf/s7_17.pdf
(Checked 24 May 2011)

# Appendix A Contacts and Questionnaire

**UK Contacts**

Judith Crompton (Environment Agency)
Mark Diamond (Environment Agency)
Jonty Gibson (Environment Agency)
Kevin Hall (Environment Agency)
Duncan Huggett (Environment Agency)
Jenny Mant (River Restoration Centre)
Chris Mainstone (Natural England)
Angus Tree (Scottish Natural Heritgae)
Jenny Wheeldon (Natural England)
Sally Woodford (Environment Agency)

**European Contacts**

Bart Fokkens (European Centre for River Restoration, Netherlands)
Andrea Goltara (CIRF, Centre for River Restoration, Italy)
Alex Kaat (Wetlands International, Netherlands)
Chris Baker (Wetlands International, Netherlands)
Jukka Jormola (SYKE, Finnish Environmental Institute)
William Oliemans (DLG, Government Service for Land and Water Management, Netherlands)

| **Question** |
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| What do you regard as the principal drivers for restoration (in order of priority if possible)? E.g. WFD, Habitats and Birds, Floods Directive; Land Use Planning, CAP |
| Are you are aware of any specific differences between UK and other European Countries (in terms of implementation of the drivers) |
| In general what do you regard as the main obstacles, barriers and constraints arising from policy drivers? |
| Also, what opportunities do you see as possible? |
| How important do you think policy integration might be? |
| What value do you place on partnerships? |
| How important are the views of stakeholders? |
| What are your views on funding mechanisms? |
| Are the issues of time and space resolvable? |
| How important is climate change adaptation to the debate? |
| How much of an obstacle does the lack of evidence present? |
| Can you recommend any good practice case studies at research or operational levels? In UK? In Europe? |
| Any other comments? |

# Appendix B Additional Case Studies

Floodplain and catchment restoration examples in the UK and wider Europe

| PROJECT NAME | COUNTRY | DESCRIPTION (SCALE) | KEY BARRIERS OR CONSTRAINTS OVERCOME | REFERENCE |
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| **FLOODPLAIN** | | | | |
| The Forth Catchment Project | United Kingdom | The project aimed at examining how wetlands in river floodplains could provide sustainable solutions to flooding or pollution. The project has worked with theoretical suggestions for using floodplains and rivers in these ways, using the River Forth in central Scotland as a case study. | • Partnership approach (public, private and voluntary organisations);<br>• Community participation through stakeholder workshops;<br>• Development of catchment management forum and integrated management plan;<br>• Use of contemporary policy and funding mechanisms. | EU LIFE (2010) (www[25]) Life and Europe's Rivers – Protecting and Improving our Water Resources, European Commission (Environment Directorate-General) Ref: LIFE99 ENV/UK/000203 |
| Somerset Levels and Moors Project | United Kingdom | The project has focused on the Parrett Catchment. There is a long history of conflict between stakeholders. As a result, the project targeted creating a new consensus on how water could be managed, looking at new ways to achieve sustainable benefits for all stakeholders. | • Policy development to facilitate restoration of flood and coastal plan wetlands;<br>• Community participation through stakeholder workshops;<br>• Dissemination of information to river catchment managers across Europe;<br>• Commissioning up-to-date facts and information to advance debate;<br>• Produce the philosophy and design for an Integrated Catchment Management Plan. | (www[15]); Ref: LIFE94 ENV/UK/000736 |

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| Fens Floodplain Project | United Kingdom | The vision for the Fens is an area (4,000 $km^2$) where wetlands have been restored to support the economic, social and environmental quality of life, so that communities benefit from their wetland and waterways heritage. | • Climate change awareness (increased flooding);<br>• Identification of unsustainable management practices;<br>• Stakeholder engagement through 'Sustainability Analysis', which involved river engineers, wildlife managers and local planners;<br>• Development of Analysis of Barriers to Change (ABC);<br>• Policy development – identification of key policy barriers;<br>• Innovative funding sourcing from charitable bodies in the UK and EU. | (www[15]); Ref: LIFE99 ENV/UK/000203 |
| Erne Sustainable Wetlands | Ireland | Restoration, or improvement, of water quality, and a better use of wetlands for the benefit of people and wildlife have driven the need to find integrated solutions through effective management. | • Community participation through development of framework and stakeholder workshops;<br>• Policy development driver;<br>• Catchment scale decision-making process through localised groups (based on sub-catchments). | (www[15]); Ref: LIFE99 ENV/UK/000203 |

| CATCHMENT | | | | |
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| The Tarland Catchment Initiative | United Kingdom | The aim of the Tarland Catchment Initiative (TCI) is to advise and implement an objective strategy for the sustainable use of the catchment and to improve the quality of the catchment's water resources, their adjacent banks and the habitats that they can support. The initial focus of the TCI is to reduce the impact of high concentrations of suspended soil sediments and coliform bacteria in the selected streams and to improve the diversity of the catchments habitats. | • Stakeholder engagement, consisting of government and local interest groups;<br>• Monitoring implemented;<br>• Community approach (education and awareness);<br>• Long term sustainable catchment management. | (www[26]) |
| Restoration of the Hampshire Avon | United Kingdom | In 2009 the Strategic Framework for the Restoration of the River Avon (SFfRRA) was developed by the Environment Agency, Natural England, Wessex Water, the Wiltshire Fisheries Association and the Wessex Chalk Streams Project. The aim is through restoration to move to a more natural functioning system that is able to adjust and respond to changes without constant management (options include channel narrowing; stock fencing; re-meandering; channel re-profiling; bed raising; reconnecting the floodplain (through embankment removal) and works at impounding structures. The river, an SSSI, is in an unfavourable condition. | • The planning and consultation stages have revealed a number of issues including initial resistance to change by some, tenants etc. (Environment Agency, pers. comm.)<br>• Recognised that restoration of such a complex and large catchment will not occur quickly and that long term planning is essential<br>• Illustrates the need to prioritise restoration actions according to available budget | Wessex Chalk Streams Project partnership (2009) (www[27]) |

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| Hampshire Avon Demonstration Test Catchment (DTC) | United Kingdom | The Hampshire Avon catchment comprises mixed agriculture and the DTC platform is focusing on using target sub-catchments on clay (River Sem), greensand (River Nadder) and chalk (Rivers Ebble and Wylye). | • 'Communities of Practice': developing bottom-up river catchment management as part of the 'big society' initiative launched by the UK coalition government;<br>• Cost-efficient savings;<br>• Multi-partner research;<br>• Multi-discipline team within national and international reputations; | (www[28]) |
| Tamar 2000 Support Project | United Kingdom | 'Tamar 2000' was launched in 1996 as a MAFF/EU partnership project working with farmers, landowners and the wider community to improve the River Tamar and its tributaries. 200 km of main river surveyed, plus 230 km of tributaries. | • Link economic benefits to environmental improvements;<br>• Encouragement of farmers to join the scheme by improving farm capital while benefiting the riparian ecosystem. | Bannister, N, Mant, J and Janes, M 2005 A review of catchment scale river restoration projects in the UK. RRC/EA |
| Cornwall River Project | United Kingdom | To improve the economic potential of Cornwall's freshwater fisheries resource, the development of which relies on a pristine riverine environment. 200km of river. | • Catchment planning;<br>• Engagement with landowners / river managers – Stakeholder engagement | (www[29]) |
| Cree Valley Catchment | United Kingdom | The project was designed to investigate methods and demonstrate techniques to minimise the negative impact commercial forestry has on water quality and aquatic biodiversity. The catchment chosen to implement the project was the Cree Valley which is within the Galloway Forest District of Forest Enterprises. | • Demonstration project – illustration of techniques for other parts of the river catchment;<br>• Allowed to development of strategic plans in Cree Catchment Area and helps implementation of the WFD in the UK. | Bannister, N, Mant, J and Janes, M 2005 A review of catchment scale river restoration projects in the UK. RRC/EA<br>Ref: LIFE99 ENV/UK/000182 |

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| Mersey Basin Campaign | United Kingdom | To address the problem of water quality and associated landward dereliction of the river Mersey and its tributaries | • Working in partnership with both the public and private sectors;<br>• Public participation so people appreciate and value the rivers, waterway and coasts of the NW;<br>• *River Valley Initiatives* – A network of sub-catchment initiatives aimed at engaging communities in individual sub-catchments throughout the project area. | (www[30]) |
| Sustainable Management of Urban Rivers and Floodplains (SMURF) | United Kingdom | To address water management and land-use planning in the urban environment and in the context of the objectives of the WFD. | • Demonstration project;<br>• Bring organisations and other key stakeholders together to share data, information and techniques in order to develop an integrated catchment management and land-use planning tool<br>• Extensive citizen consultation to define the local requirements/ objective for the future management of the river system and demonstrate the approach used. | EU LIFE (2010) (www[25]) Life and Europe's Rivers – Protecting and Improving our Water Resources, European Commission (Environment Directorate-General) Ref: 02 ENV/UK/000144 |

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| New Forest Streams | United Kingdom | The watercourses had been previously channelised leading to the loss of wet woodland and bog woodland. Restoration included re-occupation of the former meandering course and the infilling of the channelised reaches; creation of a new sinuous course where former channels had been destroyed; bed level raising using locally sourced gravels and clay; and the re-introduction of wood into channelised reaches. | • Sustainable and holistic catchment management;<br>• A communication programme was established to raise awareness about the importance of integrated management within local water basins. | Bannister, N, Mant, J and Janes, M 2005 A review of catchment scale river restoration projects in the UK. RRC/EA<br>Ref: LIFE02 NAT/UK/008544 |
| Restoring the natural dynamics of a Danube floodplain | Austria | The project aims at helping restore more natural dynamics to the Danube floodplain system to the east of Vienna, aiding the conservation of habitats and species dependent on a more river flows. | • Implemented monitoring tower to chart reappearing habitats over three years (included remote camera);<br>• Substantial media work, newspaper (4 x year), website and hosting of seminars;<br>• National and international network;<br>• Holistic and renaturalisation strategy, allowing the river to work for itself. | EU LIFE (2010) (www[25]) Life and Europe's Rivers – Protecting and Improving our Water Resources, European Commission (Environment Directorate-General)<br>Ref: LIFE98 NAT/A/5422 & LIFE02 NAT/A/8518 |

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| Boreal river basins – A cost-effective decision support system for management of boreal river basins | Finland | The project was to create a cost-effective practical tool for sustainable river management, using an interactive computer-based decision support system (DSS). | • Cost-effective approach and adequate monitoring procedures in line with WFD;<br>• Computer-based DSS designed to transferable to other EU countries;<br>• Post-project monitoring by LIFE in 2007;<br>• Project findings disseminated. | EU LIFE (2010) (www[25]) Life and Europe's Rivers – Protecting and Improving our Water Resources, European Commission (Environment Directorate-General) Ref: LIFE98 ENV/FIN/573 |
| Institutional issues with implementation of Floods Directive in Bavaria | Germany | In 2003, Bavaria developed the "Action Program 2020" in response to the floods of 1999 and 2002, which hit many countries in middle Europe and parts of Bavaria. Total funding for the program is approximately €2 billions, which is to be spent over the next 10 years (by 2020). 8km of restoration. | • Stakeholder consultation;<br>• International competition to engage communities, with workshops, guided tours and discussions; | (www[31]) |
| River Boyne | Ireland | The River Boyne was a major restoration scheme designed to ameliorate the impacts of an arterial drainage scheme on atlantic salmon and brown trout stocks. | • Monitoring implemented;<br>• Strategic approach over multiple reaches. | O'Grady, M 2006 Channels and Challenges: The enhancement of Salmonid Rivers, Central Fisheries Board, Ireland, 142pp. |

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| "Contrat de Rivière" as participative decision making tool to implement River Restoration. | Italy | The *Contrat de Rivière* (River Agreement) is a participative instrument for negotiated planning within River Restoration processes. It has been introduced and already widely implemented in France and Belgium. Now implemented in Italy. | • Emphasis on local participation and full scale planning issues;<br>• Integrated regional Water Protection Plan;<br>• Strategic shared vision able to integrate and implement specific policies in a converging path;<br>• Bottom-up watercourses culture | (www[32]) |
| Guadajoz River basin | Spain | Sustainable management plan for the Guadajoz River basin. | • Institutional coordination with setting up of "River Board";<br>• Technical innovation;<br>• Social participation;<br>• Set up foundation for a follow-up, EU co-funded programme. | EU LIFE (2010) (www[25]) Life and Europe's Rivers – Protecting and Improving our Water Resources, European Commission (Environment Directorate-General) Ref: LIFE99 ENV/E/000278 |