GOBIERNO DE ESPANA
MINISTERIO DE MEDIO AMBIENTE Y MEDIO RURAL Y MARINO

RIVER RESTORATION

BASIS OF THE NATIONAL STRATEGY FOR RIVER RESTORATION










GOBIERNO
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Prologue

Spain has changed a lot in the past few years. We have grown demographically, we have developed economically, and in the social front we have progressed to levels unimaginable four decades ago in terms of wellbeing, knowledge, and solidarity. Nevertheless, our water resources remain the same, although subject to increased pressures.

Although we now have access to alternative sources of water, such as desalination and reutilisation, and we have embarked on an ambitious plan to modernize irrigation systems, it is also true that we are more conscious of the limitations of the resource and the importance of managing it efficiently in order to satisfy domestic supply, economic, social, and environmental needs.

At the Ministry of the Environment and Rural and Marine Affairs we know that rivers and groundwaters are essential elements of our water resources, and since 2004 we have developed an intensive policy of protection, conservation, and restoration that has developed into the National Strategy for River Restoration, the basis of which are presented in this document.

The Strategy has an estimated budget of 1500 million euro until 2015, mostly targeted to rural areas, where several thousands of jobs are being created annually doing environmental work related to the four themes of the Strategy: protection, conservation, restoration, and environmental education and volunteering.

The determination of the ministry, together with the embracing of European environmental policy, has recently lead to increased work intensity in order to fulfil the requirements of the Water Framework Directive and the Directive on the assessment and management of flood risks.

Both regulations have given rise to the development of new River Basin Management Plans and future Flood Risk Management Plans, which provide the main framework for the work being carried out under the National Strategy for River Restoration.

Marta Morén Abat
Water Director General

RIVER RESTORATION

BASIS OF THE NATIONAL STRATEGY FOR RIVER RESTORATION

CHAPTER 1 INTRODUCTION

1 Introduction

The need for a National Strategy for River Restoration emerges from the context of the Water Framework Directive, in trying to achieve its purpose of preventing further deterioration of water bodies while gradually enhancing their ecological status.

It is obvious that, for the most part, rivers in Spain do not present an adequate environmental status, due to intensive usage and an exploitation of their resources which do not consider their functional integrity as ecosystems. A new approach to the management and use of water resources is required, in closer agreement with the principles of sustainable development and of biodiversity conservation, and consistent with the purpose of the Water Framework Directive.

Furthermore, and also in this new scenario created under the Water Framework Directive, the need to broaden and expand the education of technicians in charge of water planning and management in Spain becomes apparent. It can be achieved by creating multidisciplinary teams and forums for discussion and debate that will encourage citizen participation and the involvement of social partners in the management of river systems and their natural resources.

This state of affairs has lead the Ministry of the Environment and Rural and Marine Affairs to propose a new understanding of rivers, developing new areas for action around their management which will allow updating approaches and objectives, as well as designing a policy for the conservation and restoration of rivers as ecosystems with a more sustainable use of water resources. The intention is, as well, that public participation and debate be the principles behind this approach.

In the past few years, the Ministry of the Environment and Rural and Marine Affairs has dedicated a great effort to improving the management of rivers and their conservation status, and has undertaken plans and lines of action of great interest in all aspects concerning water quality (Plan to avert discharges, National Water Quality Plan: Sanitation and Treatment, Water quality monitoring networks adapted to the Water Framework Directive), concerning the monitoring of water uses (ALBERCA Program and Water Registers) as well as the protection and conservation of the Hydraulic Public Domain[1], initiating a Programme of Conservation and Enhancement of the Hydraulic Public Domain, etc. In addition, a great deal of effort is going into Water Planning, which introduces the challenge of producing new river basin management plans, indeed a great challenge for all of society.

All these initiatives of the Ministry of the Environment and Rural and Marine Affairs have resulted in great value and benefit for rivers, marking a strategic change in those aspects concerning water use and quality control. However, there are still some aspects in need of improvement, in particular those concerning the hydromorphology of river channels and riparian areas, which require the definition of new lines of action to allow the recovery of the dynamics and resilience of river systems, while gradually encouraging their restoration and conservation.

This document presents the basis for the National Strategy for River Restoration, proposing a set of measures which will improve the management of rivers and their ecological

[1] A figure in Spanish legislation referring to public waters; for river systems, it includes the river channel, but not the riparian area.

status, highlighting those aspects that are more relevant and problematic currently, to be carried out within an initial timeframe ending in 2015.

The body of this document states the scientific principles which must guide restoration and conservation actions in rivers, the most frequent issues or weaknesses in the current situation, and the alternatives or possibilities that exist in the context of European directives that must regulate in the coming years the management and conservation of water bodies.

Photo 1

Confluence of the Merdero stream (left) with the Tajo River, in the municipal district of Peñalén (Guadalajara)

Photo 2

Dike maintenance work for the retention of fine clays coming partially from kaolin mining, in the catchment of the Merdero stream. Municipal district of Peñalén (Guadalajara)

CHAPTER 2 GOAL AND BASIC PRINCIPLES OF THE PROPOSED STRATEGY

2

Goal and Basic Principles of the Proposed Strategy

2.1

Goal

In order to define the National Strategy for River Restoration it is necessary to establish its ultimate goal and lay out the principles behind it, according to its intended purpose, and validating its content, importance, and the proposed approaches.

The National Strategy for River Restoration must have as its ultimate goal the enhancement of the ecological status of all Spanish water courses; it will be one more element within the programmes of measures to be carried out in rivers in the coming years, integrated within the respective River Basin Management Plans.

Having this general goal, the National Strategy for River Restoration is envisioned as a series of actions meant to initiate a ***'process of change in the management of river systems'***, which will lead to an enhancement of the ecological status of rivers, while gradually increasing the involvement of the public.

This proposed change in the management of river systems cannot take place right away; rather, it requires a **period of assimilation** of new ideas and concepts. Therefore, it is necessary to begin its implementation as soon as possible, and try to increase awareness and acceptance of its sustaining principles, while trying to prevent the processes and threats of environmental degradation of rivers and moving forward in their ecological recovery, counting with society´s support.

Photo 3

Negro river, municipal district of Peque (Zamora). Floodplains inundated during regular floods

2.2

Basic Principles

Figure 1 presents an outline of the process that the proposed Restoration Strategy is trying to promote, involving a transition from the current status of rivers, with a varied degree of deterioration, to a good ecological status. It takes into account the foundation that must motivate such Strategy, focused, on one hand, on the scientific principles that determine river functioning under natural conditions, and, on the other hand, on the objectives and requirements of the Water Framework Directive. The scientific principles mentioned will allow the assessment of the current status of rivers, as well as the differentiation between those that still have a good ecological status, and those that have been altered and now present different levels of degradation. The principles of the Framework Directive, reinforced by the more recent European Directive on the assessment and management of flood risks, will bring about a more integrated and multidisciplinary management of river ecosystems, encouraging their restoration.

The following considerations provide greater detail on the basic principles taken into account in the preparation of the National Strategy for River Restoration:

1. Scientific knowledge on the functioning of river ecosystems, including the factors that determine variability in morphology and processes, and their functional integrity and resilience, must prevail in the management of rivers and the sustainable use of their resources. That knowledge must underpin water planning and regulation of uses in floodplains at the basin scale.

2. The objectives of the Water Framework Directive concerning 'preventing further deterioration of rivers' and 'enhancing and gradually recovering their ecological status', together with the concepts supported by

Figure 1

Foundation of the National Strategy for River Restoration, with a purpose of achieving a good ecological status of water courses through actions based in sound science and supported by the Water Framework Directive

Photo 4
Habitat diversity in river systems

the Directive of 'ecological quality', higher as the river approaches its natural state; 'biological and hydromorphological indicators' of ecological quality, complementing the information provided by indicators of the physicochemical status of waters; 'reference conditions' equivalent to a status in close resemblance to the natural state, necessary in order to assess the effects of pressures and impacts and to design the restoration of water bodies; and 'public involvement' encouraged in all processes and at all levels of management of river systems, must be included and integrated in any policy related to rivers or the use of their resources proposed in the countries of the European Union.

3. The reality of the status of rivers and the organization of their management and administration in Spain are the starting point of this Strategy. In this regard we have to consider the characteristics and natural variability of water courses, the traditional use of their resources, the management traditions and inertia within river basin institutions, and the possibilities for improvement, in fulfilment not only of the requirements of the Water Framework Directive, but also of a current demand of Spanish society, more aware than ever of environmental problems, with greater sensibility and more prone to face up the economic and social costs that may entail the restoration and conservation of aquatic ecosystems.

The legal framework and guidelines of national and EU policy, particularly pertaining to water and environment, may be summarized in a series of basic principles that will guide or restrict decisions in the National Strategy for River Restoration.

Photo 5
Obstacle to fish migration in the Tiétar River

Photo 6
The obstacle in the Tiétar River is rendered passable by building a fish ladder

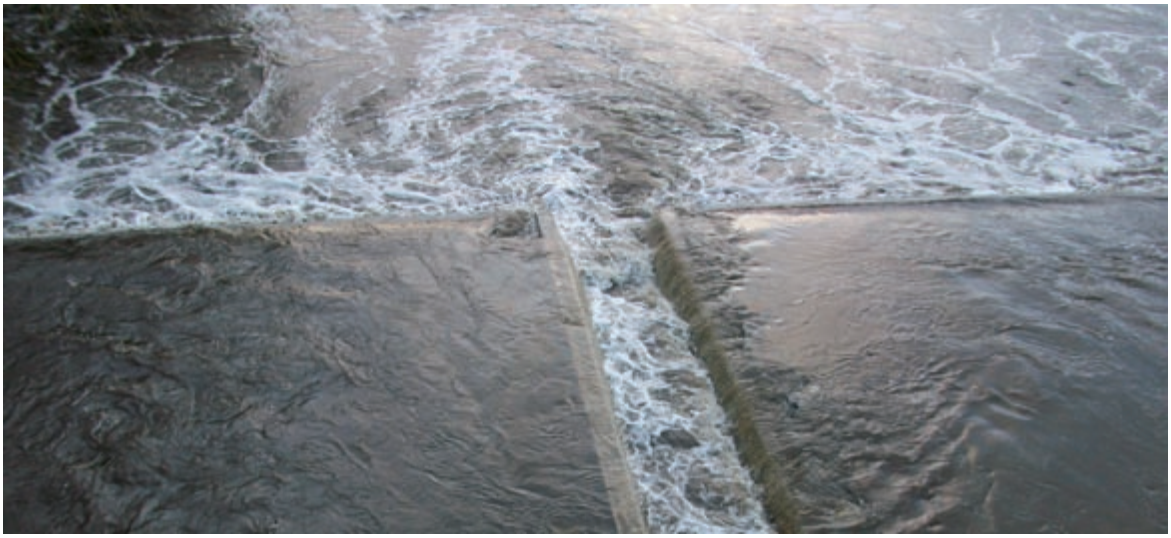

Photo 7
Point where the fish ladder meets the weir

CHAPTER 3 PROPOSED STAGES IN THE DEVELOPMENT OF THE NATIONAL STRATEGY FOR RIVER RESTORATION

3

Proposed Stages in the Development of the National Strategy for River Restoration

The proposed Strategy tries to achieve a state of rivers that will allow their use and enjoyment by all sectors of society, following a notion of 'ecological equity' where stakeholder groups interested in certain aspects of aquatic ecosystems so far not taken into consideration in planning the distribution of water resources (e.g. recreational aspects such as bathing, fishing, nature viewing, etc.) may participate along, with stakeholder groups interested in economic uses of the resources, in decisions that will determine the ecological status of water courses and the possibilities for their restoration.

In Figure 2 we have selected an image of potential uses of a river by multiple sectors of society and the set of actions that are proposed to develop the National Strategy for River Restoration.

The actions focus on the following consecutive stages:

1. Establishment of **Objectives**, explicitly stating the goal of the Strategy and the specific objectives of the different actions proposed.

2. Gathering **support** for the stated objectives, engaging those sectors of society that are to participate in the development of the strategy.

3. **Analysis** of the issues affecting rivers and their management in Spain, identifying those aspects of greater value and the weaknesses of the current situation.

Figure 2

Stages to consider in the development of the National Strategy for River Restoration

4. Establishment of **Priorities** for action in the conservation and restoration of rivers, considering the different areas of management.

5. Definition of **Lines of Work**, contemplating the activities that are considered necessary in order to enhance rivers.

6. **Implementation** of the different programs and projects defined under each of the proposed lines of work.

7. **Maintenance** of the actions undertaken and completed, including periodically monitoring and overseeing the ecological status of rivers and their progress.

8. **Monitoring** the achievement of objectives of the National Strategy and review of its approach in the short, medium, and long term, in order to continue with the proposed measures, or develop new alternatives.

Photo 8

Work on the banks of the Lozoya River, municipal district of Pinilla del Valle (Madrid)

Photo 9

Work on the channel bed in the Upper Tajo River by the NGO AEMS Ríos con Vida, part of the Volunteering Programme in Rivers of the Ministry of the Environment and Rural and Marine Affairs

CHAPTER 4 OBJECTIVES OF THE NATIONAL STRATEGY FOR RIVER RESTORATION

4

Objectives of the National Strategy for River Restoration

The **general goal** of the National Strategy for River Restoration is to:

1º.- Achieve a good ecological status of rivers, enhancing their functioning as ecosystems, within the timeframes scheduled for compliance with the Water Framework Directive.

The National Strategy outlines as well a series of specific objectives, namely:

2º.- Promote the integration of the management of river ecosystems with land use and management policies, following sustainability criteria.

Within the National Strategy for River Restoration, it is considered necessary to encourage closer connections and collaboration among administrations, jurisdictions, and technicians, in order to integrate plans for the restoration and conservation of rivers as natural corridors in the landscape within the land use and management policies that shape that landscape.

3º.- Contribute to improve training in areas related to the sustainable management of rivers and their restoration.

In order to fully engage in the tasks of restoration and conservation of rivers, it is necessary to improve the scientific and technical training of those in charge of carrying out those tasks, meaning the technicians of the different administrations, as well as the entities that draft and implement projects. It is also necessary to publicize the experiences that have taken place in other European countries and disseminate knowledge and achievements through public participation forums.

4º.- Provide information and experiences to improve the actions that are being undertaken in the realm of river restoration in Spain.

The National Strategy intends to initiate the implementation of the concepts and approaches that must guide the tasks of restoration and recovery of a good ecological status of rivers, promoting pilot or 'demonstration' projects to give exposure to the proposed objectives and obtain in the middle and long run the expected results.

5º.- Encourage citizen participation and engage all sectors of society in the management of river systems.

Finally, a last objective proposed in this National Strategy for River Restoration is the gradual involvement of society in matters relative to river management and the use and distribution of water resources, in the endorsement of agreed upon procedures, and in the maintenance and monitoring of the work done.

The achievement of these objectives will allow obtaining a series of results, focused on the following aspects:

a) Improvement of the knowledge of the natural functioning and dynamics of Spanish rivers by the technicians in charge of their management.

b) Greater awareness of the relationship between the river and its watershed, and between different river reaches, appreciating the cumulative effect of interventions in time and space.

c) More up to date and interdisciplinary training of the teams and individuals that presently draft and implement projects in rivers.

d) New approaches for sustainable use planning of water resources and for the conservation of aquatic ecosystems.

e) Greater public involvement in debates and decision making on the management of river channels and floodplains, as well as on the activities and pressures that may influence their ecological functioning.

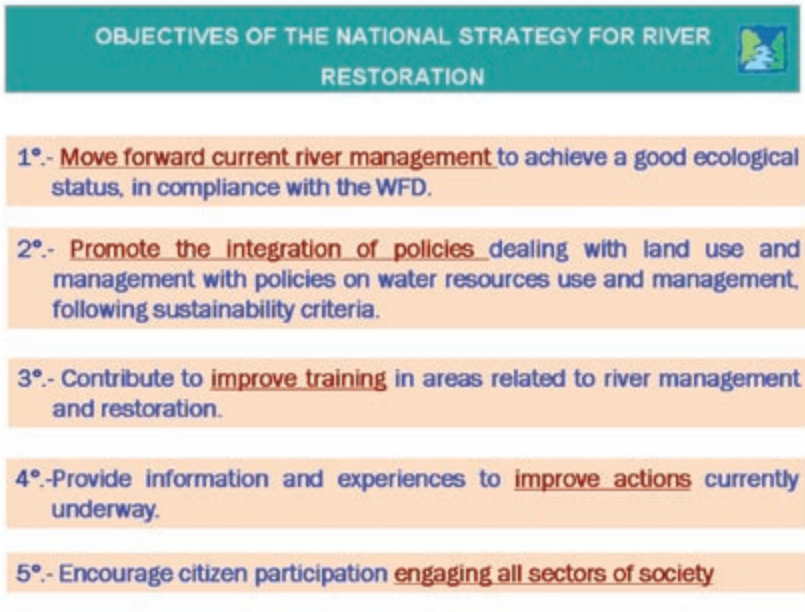

Figure 3
Objectives of the National Strategy for River Restoration

CHAPTER 5 ANALYSIS OF ISSUES AFFECTING RIVERS IN SPAIN

5

Analysis of Issues Affecting Rivers in Spain

Any proposal of actions to enhance the environmental status of rivers must begin with an understanding of the deficiencies in their structure and functioning, and look not only into the symptoms of degradation, but also into its causes. In this regard, to establish the actions under the National Strategy for River Restoration, the pressures and impacts on Spanish rivers outlined in figure 4 have been considered, followed by an analysis of their effects and possibilities for action.

To this effect, as part of the process of drafting the National Strategy for River Restoration, a series of Work Groups have been formed, each dealing with one of the pressures or impacts that are more relevant to Spanish rivers. There is a scientific or technical coordinator per group, in charge of drafting an initial working draft and coordinating group meetings. Work Group participants have discussed the initial work documents, reached agreement, and, after one or several meeting sessions, final drafts have been produced. These final documents are of great value to understand the issues that are affecting Spanish rivers, as well as the views and the degree of consensus among the different participants and social partners involved in each case.

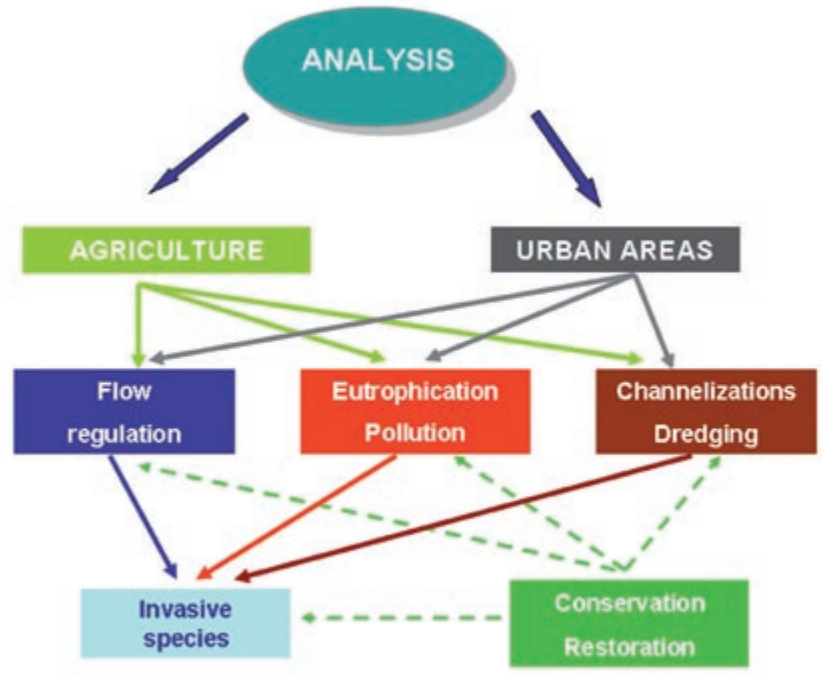

Figure 4

Main pressures and impacts on rivers considered by Work Groups in the drafting of analysis reports. The reports have been completed with information on existing opportunities for conservation and restoration

The final reports produced by each Work Group try to convey all information available on the issue at hand, of interest for impact mitigation as well as for alternatives in river restoration. The reports have been structured in three general sections:

1. Description of expected effects and impacts on rivers on the issue under study, drawn from personal experience and literature review.

2. Incidence and consequences of such impacts on Spanish rivers, based on data supplied or graphical and/or photographical evidence.

3. Suggested alternatives and recommendations to improve the current situation, stating specific measures to be developed by the respective administrations and social partners.

Work Group reports, providing the information mentioned above, as well as the list of participants involved in the discussions and drafting, are available from the webpage of the Ministry of the Environment and Rural and Marine Affairs.

The following conclusions on the issues affecting Spanish rivers are presented as a summary of the information provided by the different Work Groups:

ESTRATEGIA NACIONAL DE RESTAURACIÓN DE RÍOS

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Subdirección General de Gestión Integrada del Dominio Público Hidráulico

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Madrid, Julio de 2007

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Madrid, Septiembre de 2007

5.1

Agriculture

1. Agricultural activity represents a widespread pressure in Spain due to the extent of land under cultivation, having a greater impact on irrigated areas and areas where there is a greater over use of groundwaters. It has effects mainly on water demand, the regulation of water flows in rivers, discharges of chemical substances leading to eutrophication and water pollution, and encroachment on riparian and adjacent areas.

2. The areas considered more impacted by agricultural activity are found in different locations of the Mediterranean coast, in the middle and lower reaches of the Ebro, Tajo, Guadiana, and Guadalquivir Rivers, and in areas of La Mancha region, where both intensive irrigation and over use of groundwaters occur in areas that are highly vulnerable to water pollution.

3. The measures recommended to improve the current situation must focus on reducing the impact of agricultural practices and mitigating their effects. Such measures should be reinforced by improving the information available to farmers and by establishing enforceable regulations, following national or European directives, or the principle of environmental cross-compliance.

4. Establishing good agricultural practices, promoting efficient water use, modernizing irrigation systems, or implementing integrated environmental management systems are considered essential measures to reduce the intensity of agricultural pressures on rivers.

5. The establishment of protective riparian vegetation corridors and the preservation of agricultural lands surrounding urban areas, while encouraging their protection as green buffers and as areas that can be used for recreation and environmental education, are some actions that could mitigate the effects of agricultural activities on rivers and contribute substantially to improving their environmental quality; at the same time, they increase landscape diversity and implicate many sectors and community groups.

Photo 10

Land adjacent to the river donated by farmers for restoration purposes in the Piedra River, municipal districts of Cimballa and Llumes (Zaragoza)

5.2

Urban Areas and their Effects on Rivers

1. In the past few years, intense urban sprawl has lead to substantial pressures on Spanish rivers, causing important deterioration, restricting channel migration, river dynamics, and the potential for natural regeneration of their biological structure.

2. The measures available to administrations have not been sufficient to control infringements on the Hydraulic Public Domain, morphological changes of rivers, and alterations to the topography of floodplains. Citizens have perceived these actions as inevitable, with great losses to the natural heritage of many regions and increased flood risks.

3. Many interventions on rivers that present a degradation of their ecological status have been done to mitigate the deficiencies of urban planning. There is a lack of coordination between the different administrations with jurisdiction over the Hydraulic Public Domain and those responsible for urban and regional land use planning.

4. There is an imbalance between the capacity of municipal governments to change the landscape through urban development, the functioning of rivers and their perceived importance, and municipal decision-making capacity when it comes to planning regional infrastructures. There is also an imbalance between the coordination of water planning processes and conservation strategies for natural areas. Currently there are no mechanisms to strategically assess in an adequate manner the cumulative impact of actions by individual municipal governments on a regional or national scale.

Photo 11

Urban development by the river channel. Comparison of photos from 1956 and 2008. Orbigo River in Carrizo de la Ribera (León)

5. General municipal urban plans must establish a zoning system for land development compatible with the natural dynamics of existing rivers, respecting rivers and riparian areas as environmental and landscape elements of great value and interest for conservation. They improve a city´s microclimate, provide space for recreational activities, and serve as natural corridors connecting the urban core with suburban green belts, and these with better preserved upper basin areas.

5.3

Flow Regulation

1. A large number of rivers in Spain present a cumulative impact of flow regulation, which alters their natural flow regime. For the most part, flows are regulated for irrigation purposes, for hydroelectric power production, and for domestic water supply in areas with water resource scarcity.

2. Water flow regulation has increased since the 1960s and nowadays there is a large number of dams, weirs, and water transfers that have modified the aquatic habitat of rivers. As a result, rivers have lost in part their torrential nature, native fish populations have declined, migratory species have disappeared, and there are invasions of exotic species.

3. Currently, a process is underway to implement environmental flow regimes, although in many regions difficulties are expected when it comes to reaching agreement among water users.

4. Decreasing the intensity of flow regulation is perceived as a much needed measure to enhance the ecological status of rivers; accelerating the implementation of ecological flows and coordination processes is recommended.

5. Another recommendation is to assess some of the existing water control structures, removing some that are not currently used, and analysing those for which the current use benefits do not offset adequately their ecological impact.

6. Some of the inertias and traditional issues in this regard are highlighted below:

- Insufficient qualified personnel to study and implement ecological flows.
- Insufficient protection of the physical habitat in rivers by environmental agencies
- Insufficient coordination between administrations with competencies on rivers
- Regime of water use rights inappropriate in terms of quantity, conditions, and duration.
- Insufficient control and monitoring of flows.
- Limited public involvement in support of environmental flows.
- Limited scientific studies to validate the suitability of the proposed environmental regimes.

Photos 12 and 13

Different types of water control structures (upper photo, Pisuerga River, Aguilar de Campoó Dam, Palencia; lower photo, Pisuerga River, weir de la Horadada, close to Santa María de Mave, Palencia)

5.4

Morphological Alterations to the River Channel: Dredging and Channelisation

1. Processes of channel migration and river dynamics are necessary to maintain a good ecological status of rivers. Presently, the Spanish river network has lost these attributes to a great extent, due to channelisation and lining of the channel´s substrate. These engineering works have brought about the establishment of urban settlements and infrastructure works in floodplains, which in turn demand a stricter control of channel dynamics, thereby increasing the flooding risk in those areas.

2. Engineering works to straighten and dredge river channels have frequently been carried out as urgent measures, or right after floods occur, without conducting previously any scientific/technical studies to determine the suitability of those actions or the best way to accomplish them.

3. A vast majority of Spanish rivers are showing a geomorphological imbalance and numerous processes of incision due to a sediment deficit, resulting from decreased sediment delivery to certain reaches. The causes are several: erosion control in hillsides (increased vegetation cover and reduction in the amount of pastures and cultivated land in mountainsides) and channels (channelisations and substrate lining), retention of sediments by water control structures, and in-stream sediment mining.

Photo 14

Bank of the Órbigo River (León) protected with a stretch of rock armour

Photo 15
Effects of in-stream sediment mining. Ablanquejo River (Guadalajara)

4. The difficulty of mitigating these effects on rivers and the elevated costs of some of the suggested alternatives are acknowledged, such as may be the extraction of accumulated sediment from the tail areas of reservoirs and discharging it in river reaches downstream, mitigating the effects of dams. Avoiding channel dredging and in-stream sediment mining is highly recommended.

5. In order to achieve the ecological restoration of rivers and riparian areas, it is necessary to delimit the area that would allow channel migration processes to take place in each stretch of the river, conserving the river´s dynamics and processes. In order to do this, several concepts and procedures are proposed, acknowledging the actual difficulty of mapping these boundaries, which must be based on hydrological and geomorphological criteria, and on the particularities of each river valley and stretch.

6. Regional land use planning processes are recommended as the fundamental tool to deal with issues affecting flood prone areas. To this effect, this document emphasizes the need to have the necessary coordination between administrations and between agricultural and forestry policies, urban planning, and infrastructure and transportation planning processes, as well as the suitability of approaching river management from a multidisciplinary perspective, broadening the specialization of the technicians involved.

5.5

Introductions of Exotic Species

1. Introductions of exotic species are considered one of the main threats to the conservation of native species, causing the substitution and progressive elimination of the latter through processes of depredation, hybridisation, introduction of diseases, alterations to the habitat, and competition for resources or habitat.

2. The introductions in Spanish rivers are due to alterations to the aquatic environment, particularly in middle and lower river reaches, where the increase in introduced species has been exponential since the 1960s, coinciding with an increase in flow regulation (loss of torrential nature, decrease in flow seasonality and inter-annual variability). Increased eutrophication and a decrease in moisture in riparian soils have also greatly influenced the proliferation of invasive plant species, which easily grow in the altered substrate of riparian areas, where permeable gravel material has been substituted by a substrate with higher clay content, impermeable or sterile, thereby losing the natural moisture gradients.

3. It is necessary to differentiate between several cases of species introductions: exotic species (equivalent to alien or allochthonous and non native) are those coming from other countries and whose presence is a result of human action, directly or indirectly; invasive species are those that reproduce successfully in the new environment and take the place of Spanish native species, with or without human help; and translocated species are those that are native to Spain but that have been introduced into basins where they did not previously occur. In all cases, such species may or may not become naturalized (they survive and reproduce successfully) or not to the location of the introduction.

According to the above definitions, in Spain there are 27 exotic fish species, of which 23 are invasive, and 25 are naturalised (they reproduce successfully). By and large they have a very wide distribution, and 12 of them have a very negative impact on river ecosystems in the Iberian peninsula. Regarding native fish species, where a large number are endemic, 52 of the 59 fish species occurring in the Iberian peninsula are threatened, with 10 of them being critically endangered, and 9 being endangered.

Regarding other fauna, species to note that occur in Spanish rivers are the American mink, the Florida red-eared slider, and the Chinese softshell turtle; among the invertebrates, the zebra mussel, The Asian clam, the Newzealand mudsnail and the Malaysian trumpet snail. Among the arthropods, the American red swamp crayfish causes the greater impact. All of the above are invasive species naturalised to our environment, many of them of widespread distribution.

Regarding flora, there are numerous exotic species invading riparian areas. The following are frequently found: acacia, ailanthus and eucalyptus, Japanese privet, several varieties of poplar used for paper production or gardening, weeping willow, and European white elm; also to note are shrub and herbaceous gardening species (e.g. summer lilac, agave, giant cane, etc.). Worth noting are some aquatic invasive species such as the water fern and the water hyacinth, with a negative impact on waters.

Regarding translocated species, there are many examples of introductions of Iberian fish species to basins where they did not previously occur, causing a decline of endemic species. As well, plant species such as poplar and elm have been artificially propagated in certain regions

Photo 16

Example of invasion of the river bed by cane communities, common in Mediterranean watersheds in our peninsula. Guigüela River, municipal district of Torrejoncillo del Rey (Cuenca)

where there are no records of them occurring naturally.

4. The main source of invasive species introductions in Spain has been, for the most part, sport fishing and the aquarium industry, in the case of fauna species, and gardening in the case of vegetation. Currently it is very difficult to control and prevent their proliferation.

5. In order to solve this problem, several measures of great interest are proposed, focused on the following aspects:

– Improving the information available on the status of Spanish rivers, creating a current inventory including a measure of the intensity of the problem in each river, and establishing priorities for action.

– Prevention measures, namely different actions in the legislative front to improve and complement existing regulations for the control of exotic species under cultivation, supporting enforcement actions (management of reported violations and river monitoring), environmental education and actions to increase public awareness on the problem of invasive species, and coordination between administrations, joining efforts to control the problem.

– River protection measures and eradication of invasive species, through controlled fishing campaigns, biological control, application

Photo 17

Often certain river uses (in the image the river is integrated into the local sanitation network) lead to the occurrence and development of invasive species

of toxic substances, etc.; effecting changes in current fishing legislation; and proceeding to restore rivers and the environmental conditions of riparian areas, reinstating, as a first step, the natural flow regime or an environmental flow regime that incorporates the fluctuation and torrential nature that are appropriate to each river reach.

5.6

River Conservation

1. The role that protected areas can have in the management of the water cycle is worth noting, although the processes of designation of such areas have paid little attention to it. In most cases, the surface area under protection is not sufficient to ensure an adequate hydrological function of the ecosystems within it.

2. On a global scale, rivers and their riparian areas are relatively underrepresented in protected area networks. In Spain, of a total of 258 protected areas, almost one half of them (133) have been designated because of the interest of their aquatic ecosystems, located at headwater areas, in upper reaches of high scenic quality (e.g. National Parks in mountain areas), or in wetland or river mouth areas of great interest for the conservation of birds. However, hardly any area has been protected with the specific purpose of conserving the river ecosystem itself.

3. In addition to providing water resources, rivers perform multiple ecological functions that are essential for the global function of the landscape, such as serving as ecological corridors. Only the regional governments of Andalucía and Extremadura have declared protected areas around rivers recognizing their role as ecological corridors, and only the law for the Conservation of Nature and Natural Sites in the region of Extremadura incorporates corridors as a specific designation; the wording of this law specifies water courses and water bodies, and their riparian areas.

4. There are many sources of impacts and threats that make river conservation a difficult task, notably the pressures derived from agricultural and irrigation activities, livestock farming, the presence of obstacles in river channels that prevent species´ migration, alterations to channel continuity and connectivity with riparian areas, floodplains or groundwater bodies, water quality deterioration, etc. Also important are deficiencies in legislation, river monitoring, perception of problems and social awareness, information available, coordination between administrations, etc.

5. The factors that determine the ecological integrity or health of rivers act at scales that surpass the administrative limits of their management. Therefore, it becomes necessary to coordinate different water policies, regional land use policies, and conservation policies, and to integrate existing protected area management plans with water planning processes, while coordinating the monitoring and enforcement services of rivers and riparian areas.

6. Several measures are proposed to improve river conservation policies in Spain; among them, the following may be emphasized:

– coordination of sector policies that influence rivers (water, agricultural, urban, conservation policies, etc.)

– consideration of the water cycle in the designation and planning of protected areas; particularly of interest would be to protect headwater areas and areas of infiltration, recharge and discharge of groundwater, at the basin scale.

– reinforcement of legislation and compliance, broadening the concept of Hydraulic Public Domain to include areas adjacent to the channel that belong to the river system.

– improvement of the information available and encouragement of public involvement, by creating specific lines of research, educational campaigns to eradicate false beliefs on 'river pathologies', and promoting awareness of natural and cultural heritage; as well, supporting volunteering efforts, agreements with riparian landowners, and the participation of social partners as main actors in conservation policies, etc.

5.7

Issues Emphasized by all Groups

Although each Work Group has analysed the issues affecting rivers from a different perspective, all of them have noted the following issues:

– Need to improve the training of technicians in charge of river management, as they have to deal with new requirements and regulations.

– Need to improve the coordination between administrations, and integrate river restora-

tion with policies on regional land use planning, agriculture and rural development, and urban planning.

– Agricultural and urban activity are the main pressures on Spanish rivers, leading to flow regulation, dredging and channelling works, and water pollution as the main impacts. They have a significant effect on the proliferation of exotic invasive species, which pose a serious threat to native species.

– Need to increase monitoring of rivers and their flows, to detect and fine possible infringements into the Hydraulic Public Domain. Also, need to enhance public participation as it will contribute to the maintenance and protection of rivers and riparian areas.

– Need studies to delimit rivers and their area of influence, and plan land uses in flood prone areas, to analyse the status of rivers in terms of occurrence of invasive species, and to analyse the role of protected areas in the conservation of the functions and services of river systems.

Photo 18
Urban stretch of the Ucero River at El Burgo de Osma (Soria)

Photo 19

Bioengineering techniques. The image shows a brush mattress to stabilize the bank in the Lozoya River, municipal district of Pinilla del Valle (Madrid)

Photo 20

Electric fishing methods to study the progression of fish populations

CHAPTER 6 PRIORITIES FOR ACTION

6

Priorities for Action

Bearing in mind the issues outlined, and considering the objectives of the Water Framework Directive, the following actions are proposed within the framework of the National Strategy, listed in order of priority and importance (figure 5):

1. Prevent any further deterioration of rivers, as regards the physical and biological integrity of channels and riparian areas.

Considering how common are activities that degrade rivers through morphological alterations to the river network by different sectors or entities, actions to prevent additional deterioration are focused on them, proposing the following measures:

a) Pay special attention to river protection, establishing mechanisms to prevent additional pressures that may contribute to their degradation, allowing rivers to overflow and dissipate energy during floods whenever possible, and analysing in detail the environmental consequences of any activity.

b) Any activity planned in rivers should be preceded by an analysis of the current situation, rationale and purpose, as well as an evaluation of the cost-effectiveness and the environmental impact or benefit to the river ecosystem of the proposed activity. Biological, hydromorphological, and physic-chemical

Figure 5
Establishment of priorities within the National Strategy for River Restoration

Photo 21
Biological sampling detail

Photo 22
Dipnet for macroinvertebrate sampling

factors must be considered, as specified by the quality elements for the classification of ecological status in the Water Framework Directive.

c) Avoid doing any urgent work in river channels immediately after flooding without the necessary analysis and informed reports on its suitability and recommended approach.

d) Initiate as soon as possible the implementation of the Directive on Flood Risks, so that basin organizations will have their Flood Risk Management Plans, and will be able to proceed with citizen information and awareness campaigns on floods as natural phenomena, their environmental benefits, and the risks to property and individuals in flood prone areas.

e) Increase monitoring efforts in rivers and ensure that river basin organizations have specialized staff to report on the effects on rivers of irrigation plans, rural development plans, urban plans, transportation infrastructure, water abstractions, in-stream mining, etc.

2. Conserve the stretches with a higher ecological status, through direct measures of conservation and protection, or indirect measures to eliminate threats and pressures. The following actions are proposed:

a) Creation of a Network of Protected Rivers, under the terms of Spanish Water Law, (Ley de Aguas), as well as creating an inventory of rivers without any flow regulation to allow evaluating their conservation interest and identifying the risks of deterioration.

b) Integrate protected area management plans into river basin management plans, thereby strengthening the tasks of monitoring and maintenance of the ecological status of the aquatic ecosystems enclosed within the protected areas.

3. Decrease pressures and impacts on rivers, undertaking different actions to facilitate the following improvements:

– Coordination between administrations with jurisdiction over irrigation and urban planning policies, trying to make progress in the areas of water consumption efficiency, control of pollution discharges and of nonpoint source pollution.

– Integration of river restoration policies into regional land use planning, delimiting river corridors free from encroachment by agricultural activity, urban settlements, or transportation infrastructure.

– Establishment of agreements or collaborations with riparian land owners on impact mitigation policies and restoration of waterways.

– Incorporation of the objectives of ecological restoration into river basin management plans, and definition and compliance with environmental flow regimes in all regulated rivers.

4. Restore and rehabilitate river reaches with structural and functional deficiencies, establishing priorities between them as per the following criteria:

– Current ecological status; it is advisable to initiate work on the reaches that present a higher status, or wherever smaller investments will achieve a higher return in terms of environmental enhancement.

Photo 23

Tree caliper and forms for field data used in studies of riparian vegetation

Photos 24, 25, 26 and 27

Different phases of construction work of a fish passage at a weir that posed an obstacle for fish migration, the location is the Negro River, in the municipal district of Peque (Zamora)

– Social interest of the reach to restore or rehabilitate, giving priority to urban reaches or those where the benefits of the restoration action may affect a larger number of people.

– Scientific interest of the restoration action, due to its influence on the recovery of endangered native species or species of biogeographic or cultural interest, etc.

– Location in protected areas or in areas of interest for their natural or cultural heritage.

In order to accomplish these actions, and from the beginning of their implementation, it will be necessary to perform the following tasks:

– Improvement of the training of technicians, facilitating information and experiences

– Campaigns to provide information and raise social awareness.

– Seek direct and indirect sources of funding, which may come not only from river basin organizations, but also from funds or subsidies from agricultural jurisdictions, rural development funds, from contributions by business companies or associations, collaborations from financial entities, etc.

– Collaboration between technicians and administrations.

CHAPTER 7 DEFINITION OF LINES OF WORK

7

Definition of Lines of Work

In order to better coordinate actions under the National Strategy for River Restoration, several lines of work, which constitute different Programmes, are proposed as follows; each of them comprises various Projects (see Figure 6).

7.1

Environmental Education and Training

This line of work comprises a series of priority actions, some of them already underway, with the purpose of improving the level of training of technicians and the environmental education of society as a whole. The intention is to improve public awareness of the value of rivers

Figure 6

Proposed lines of action for the Development of the National Strategy for River Restoration in Spain

with a good ecological status, and about the need to become involved in changing behaviours and attitudes towards rivers.

The proposed work is targeted to two distinct groups, designing for each one of them different actions, as follows:

7.1.1. Technicians and professionals in charge of regional administrative management, in particular rivers and their resources, drafting projects, reports, etc. A training program is already underway for this group, consisting of training courses and seminars, publication of scientific/technical books, magazines, and manuals, holding periodical meetings and work groups to disseminate and exchange experiences on river restoration, staying in touch with subject experts from different countries, and, lastly, incorporating new concepts into the educational programmes for the different professions involved. The following actions are planned:

Table 1

Actions intended for technicians, professionals, and the general public

Chapter	Action	Estimation completion date
New publications	 Methodology Guide to develop river restoration projects	February 2008
	 Guide to the Legal framework for river restoration	September 2009
	Technical guide to delineate Hydraulic Public Domain and flood prone areas	May 2010
	Characterization of riparian vegetation in Spain	September 2010
	Manual of good practices for the conservation and maintenance of rivers	Dicember 2010
	Guide of good practices for reservoir management	July 2010
	Guide of good practices for public participation processes in river restoration projects	September 2010
Courses and seminars	Course on river restoration	Annual event starting in March 2008
	 International Seminar on River Restoration	Annual event, being held since 2006
Exchanges of experiences	Development of an inventory of projects and experiences available on the Internet	February 2008

Chapter	Action	Estimated date
Environmental education for the general public	 Environmental education and dissemination activities in educational institutions	Implemented since November 2007
	Programa de Voluntariado en ríos Environmental education activities for the general public through the Volunteering Programme in rivers	Implemented since September 2007
	 Production of supporting materials for environmental education activities in rivers, directed to local governments and NGOs	Implemented since September 2007

7.1.2. General public, where several distinct groups may be differentiated, by age, level of education, etc. An environmental educational programme is proposed for this group, including information and awareness campaigns, engaging education professionals at the primary and secondary school levels, as well as technicians in environmental education that exist in many municipalities, specialized companies, NGOs, etc. The activities planned are outlined in Table 1 above.

7.2

Protection and Conservation

This line of work encompasses all actions to enhance the conservation and protection of rivers. It must include measures for knowledge acquisition and for developing and implementing the Register of Protected Rivers, measures for the protection of waterways, measures to improve the status of degraded rivers and measures to promote coordination between administrations, integrating water planning with protected area conservation policies and with regional land use planning at the basin scale, including in the latter agricultural and rural development policies, and urban planning (see Figure 6).

7.2.1. Register of Protected Rivers. Conservation and Protection Plans

In order to attain effective conservation and protection of Spanish rivers, it is necessary to improve available knowledge. To this effect, the Environmental Engineering Department of the Centro de Estudios y Experimentación de Obras Públicas (CEDEX), has been initially commissioned to carry out the background technical research needed to develop a Register of Protected Rivers.

The development of this Register is based on Law 11/2005, of June 22, which modifies Law 10/2001, of July 5, on the National Hy-

Table 2
Actions directed to protection and conservation

Capítulo	Actuación	Fecha prevista
Protection and Conservation	Network of Protected Rivers	Development in parallel with River Basin Management Plans
	National Cartographic System of Flood-prone Areas	Implemented since September 2007
	 River conservation programme	Implemented since 2006
	 Increased monitoring of Hydraulic Public Domain and improvements to the management of disciplinary proceedings	Implemented since 2006
	 Volunteering Programme to monitor waterways	Implemented since September 2007

drological Plan. This Law included the following paragraph:

Four. Section 1.b.c') of article 42 is worded as follows:

'*The allocation and preservation of resources for current and future uses and demands, as well as for the conservation and recovery of the natural environment. To this effect, the following will be determined:*

– *ecological flows, defined as those that allow, as a minimum, the existence of the fish populations that the river naturally sustains or could sustain, as well as the associated riparian vegetation.*

– *river natural reserves, with the purpose of preserving, without alterations, those river reaches with limited or no human influence. These reserves will be confined within the boundaries of the Hydraulic Public Domain.*'

The objective is, therefore, with this legal text as a basis, to select and create a Network of Protected Rivers. This Reserve Network expects to achieve the following purposes:

– Protection and conservation of river reaches unaltered by human activity in the different Spanish river basins.

– Maintaining a vast number of river reaches, representative of the biological diversity that can still be found in the different types of river ecosystems in Spain, and that may be used as reference reaches within the scope of the objectives set by the Water Framework Directive (2000/60/CE).

– Selection of river reaches that deserve a special recovery effort, in the vicinity of the future Protected Rivers, with the purpose of establishing a real network of biological corridors around waterways, providing a structure and connectivity to the areas currently protected as part of the Natura 2000 Network.

Finally, and given the interest of the landscape, recreational, and cultural values of rivers, a list of scenic reaches or river landscapes of special conservation interest has been identified. These are stretches of river where, even though there has been alteration by human activity, their socio-environmental and cultural values call for their protection and conservation.

Once these Reserves have been identified, Conservation and Protection Plan will be drafted for them. Research studies will be necessary to

Photo 28

Upper Tiétar River, a possible Nature Reserve. Municipal district of Piedralaves (Ávila)

explicitly describe the status of the following hydromorphological and biological characteristics:

- Extent of alteration of the flow regime.
- Extent of alteration of the morphology and dynamics of the river system.
- Water and sediment flow continuity and restrictions to fish migration.
- Lateral and vertical connectivity of the river system and connections with local and regional groundwater bodies.
- Status of riparian areas, including the extent of alteration of their surface area, the composition and structure of the vegetation as it compares to what is considered natural for each stretch of river, and evidence of natural regeneration or degree to which restrictions would be necessary in order for regeneration to occur.
- Distribution and status of populations of endemic species or species of high conservation interest.
- Composition and structure of current aquatic communities and deviation from what is considered natural for each stretch of river.
- Risk of introductions of new invasive species in the short and medium term, whether exotic, or native coming from other basins or stretches of the river.

Once the current environmental status of rivers is known, it will be advisable to differentiate those stretches with 'very good ecological status', where no further work will be required, since their conservation is ensured by virtue of their location in areas already protected, or in environments without any significant threats, from stretches with a 'good ecological status', which will require protection measures to improve their ecological integrity or to avoid existing or anticipated pressures or threats. In the latter actions will be required more urgently to prevent their deterioration.

Furthermore, the measures to be adopted for Protected Rivers will be integrated with water planning processes in the basin where they are located, and must be coordinated with the planning and management of other protected areas in their region, and with regional land use planning, rural development and urban planning policies that may affect them, under the responsible administrations.

7.2.2. National Cartographic System of Flood-prone Areas.

Royal Decree 9/2008 (BOE 16-1-08), modifying the Regulations on the Hydraulic Public Domain, (Reglamento del Dominio Público Hidráulico), included the National Cartographic System of Flood-prone Areas as a basic tool for regional planning, to identify and manage adequately flood-prone areas, with the purpose of reducing future damage caused by flood events, at the same time as preserving watercourses and their natural retention areas in order to achieve an optimum ecological status.

The development of the National Cartographic System of Flood-prone Areas makes available to all administrations and to the general public flood hazard maps prepared by the Ministry of the Environment and Rural and Marine Affairs in collaboration with regional governments, as well as other maps provided by regional governments as part of their responsibilities.

The main tool of the National Cartographic System of Flood-prone Areas (SNCZI is its acronym in Spanish) is a cartographic viewer, a supporting tool for the management of watercourses, prevention of natural risks, regional planning, and administrative transparency. This

viewer is available in the address http://www.mma.es/snczi, and has a series of support functions to make it an easy Internet tool to use.

It allows viewing the maps of flood-prone areas produced to date by the Ministry of the Environment and Rural and Marine Affairs, as well as those provided by regional governments. More than 60 000 km of flood-prone areas can be looked up. The area of interest can be looked up in cadastral maps, aerial photography, or topographic maps among others. It is possible to locate a site anywhere in Spain using administrative boundaries (regions, provinces, municipal districts), hydrographical criteria (basin district, basin, dams and reservoirs), or UTM coordinates.

The viewer includes an inventory of river reaches for which studies are available, the probable and official boundaries of the Hydraulic Public Domain, and flood-prone areas delimited following geomorphological criteria, associated to management regulations for dams, as well as flood-prone areas associated to different return periods (up to 500-year flood events), as delimited by departments in charge of civil protection, regional planning, and water management (Basin Organizations and Water Agencies).

Furthermore, the Ministry of the Environment and Rural and Marine Affairs continues to develop the National Cartographic System of Flood-prone Areas, incorporating gradually cartographic data for new areas, thus fulfilling the requirements of the European Directive on the assessment and management of flood risks.

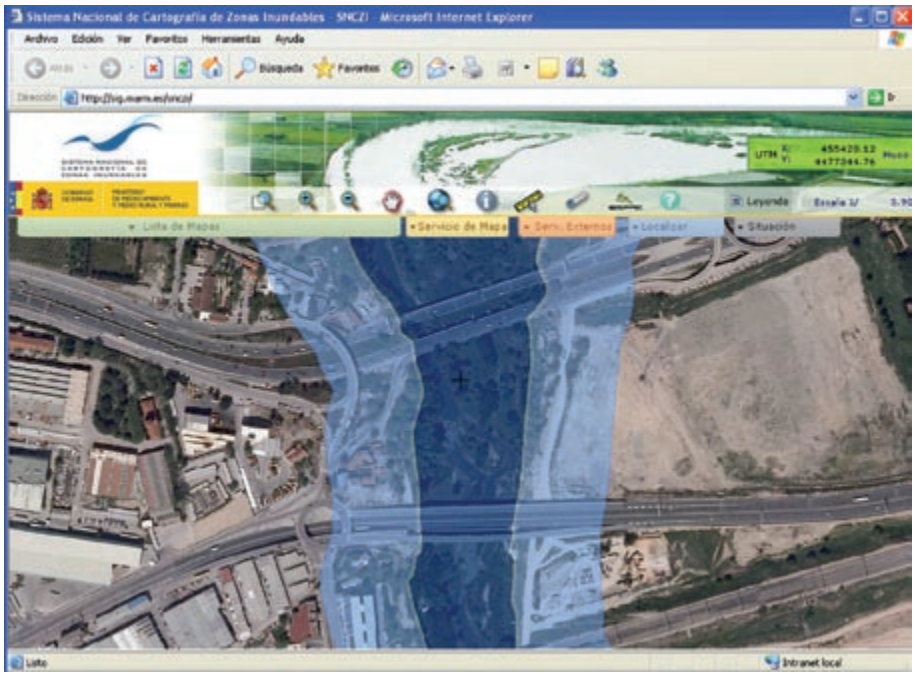

Photo 29

Hydraulic Public Domain and monitoring area (100 m wide corridor measured inland from each bank) in the Jarama River, municipal district of Coslada (Madrid), produced by the cartographic viewer of the National Cartographic System of Flood-prone Areas.

7.2.3. River conservation programme.

Since May 2005 the Ministry of the Environment and Rural and Marine Affairs has been developing a programme of conservation actions in rivers that has completed over 2 300 small projects with the purpose of improving as much as possible the status of our rivers while minimizing flooding risks that in some cases stem from the general state of degradation of our rivers.

With this Programme, Basin Organizations have the staff and resources to carry out simple conservation projects, such clean up operations to remove waste, debris, rubbish and vegetation clippings, removal of invasive species, removal of dead fish during droughts, improvements to fish habitat conditions, elimination of weirs, construction of fish ladders, improvements for the public use of rivers, plantations, barriers for livestock to improve riparian vegetation, etc., as well as simple projects of bank stabilization.

The web pages of the Ministry of the Environment and Rural and Marine Affairs and of the Basin Organizations contained detailed information on the projects, locations, their magnitude, etc.

Programme effectiveness is being continuously reviewed; as a result a Manual of good practices for the conservation and maintenance of rivers will be assembled, analysing the different types of actions as well their social and environmental cost-effectiveness.

7.2.4. Increased monitoring of the Hydraulic Public Domain and improvements to the management of disciplinary proceedings.

As stated in previous chapters, it is necessary to increase the staff and resources assigned to surveillance and monitoring activities in our rivers, in order to prevent possible impacts on waterways, and allow timely disciplinary proceedings to avoid new impacts.

To this effect, it should be noted that the ratio of Environmental and River Enforcement Agents to unit of surface area is far from approaching the ratios of Forest Enforcement Agents depending from Regional Governments, although with the creation of the Environmental Enforcement Service in the Ministry of the Environment and Rural and Marine Affairs this situation is improving with an increased number of agents. Within the framework of this Strategy, since 2006, each Basin Organization is being provided with contracts to support these Services with the staff and resources needed to increase monitoring efforts, to be expanded in the coming years. Coordination with the environmental monitoring services of other ad-

Photo 30

State of the Ibor River immediately after the demolition of a weir that had become obsolete. Municipal districts of Castañar and Fresnedoso de Ibor (Cáceres)

Photo 31
Recovery of riparian vegetation in the Zújar River (Badajoz)

ministrations must improve as well, in particular with forest and rural environment enforcement agents, and the services of the Nature Protection Service (SEPRONA, part of the National Security Forces).

This work has already produced benefits, increasing remarkably the number of disciplinary proceedings finalized in the last two years. Nevertheless, it is necessary to continue to improve the management of disciplinary proceedings by increasing the staff and resources assigned to this task, at the same time as developing computer applications to facilitate file processing.

Finally, the publication of the Ministerial Order of Valuation of damages, as per article 326.1 of the Regulations on the Hydraulic Public Domain, increases significantly the valuation of damages to rivers, by considering as part of the assessment of damages the effects on the environmental quality of the river stretch, the cost of restoration and the time needed for recovery.

7.2.5. Volunteering Programme and monitoring of waterways.

Within the Volunteering Programme, it is advisable to include the categories of volunteer and monitoring activities, to promote positive attitudes towards conservation while preventing the deterioration of rivers by detecting and reporting infringements and damages.

7.3

Restoration and Rehabilitation

This line of work is structured into three areas of action: on one hand, the elements of the drainage basin, under the jurisdiction of regional and local governments, except for groundwater bodies; on the other hand, water courses, where in turn we may differentiate urban stretches from those that are rural or not urban in nature, since there are many differences regarding issues affecting them and possibilities for action.

7.3.1. Actions in the drainage basin.

The National Strategy for River Restoration will provide opportunities for collaboration with regional and local governments to carry out the following actions in the drainage basin:

– Promotion of the hydrological restoration of hillsides, supporting regional governments through policies to improve vegetation cover and control of human induced processes of erosion.

– Identification and protection of preferential areas of infiltration and recharge of groundwater bodies, and of areas where periodically there could be surface runoff due to soil saturation.

– Monitoring of the water table and abstractions of groundwater.

– Protection and conservation of wetlands, identifying their natural mechanisms of water recharge and protecting soil conditions that favour it, at a local and regional scale, in coordination with Law 42/2007.

– Contribution to the drafting of documents to encourage good building practices in flood-prone areas, with the intention of incorporating them into urban planning regulations.

– Strategic evaluation of land uses and activities in the basin and their effect on the hydrological, geomorphological and biological condition of river systems.

– All these actions will complement the monitoring programmes and programmes of measures that arise from Water Planning processes.

Photo 32

The possibilities of recovery of the natural river dynamics depend on the correct management of the basin

7.3.2. Actions in water courses.

When referring to actions on water courses, we may differentiate between rehabilitation projects, focused mainly on urban stretches or stretches where there is a greater risk of high waters and flooding, and restoration projects, which may take place in non urban areas with greater possibilities of recovery.

In urban stretches of river, the National Strategy will support rehabilitation projects per se, improving the hydrological function and ecology of water courses, enlarging riparian zones and increasing their vegetation cover; these activities will decrease hydrological risks and enhance the recreation and scenic values of the river as it flows through the town or city. In addition, the National Strategy will work towards the coordination of the following actions:

- Collaboration with multidisciplinary teams in the preparation of urban plans and the regulation of uses in urban flood-prone areas, including the development of land use by-laws for such areas.
- Environmental education in urban areas and involvement of educational institutions in the conservation of urban waterways.
- Participation of volunteers, neighbourhood associations and other groups in the monitoring of urban waterways.
- Organization of recreational or cultural activities in urban waterways, recovery of cultural heritage, etc.

In non urban river stretches, the National Strategy will support primarily restoration projects per se, recovering as much as possible their ecological function and integrity, their dynamics and resilience. Additionally, the National Strategy will support the following generic actions:

- Putting in place protective vegetation along river channels, proposing measures in agreement with riparian land owners, and contributing to financing their set up and maintenance.
- Plans to promote water efficiency, improvement of irrigation practices, and control of fertilizer and pesticide inputs.
- Guides for the restoration of aggregate extraction operations in floodplains.
- Collaboration with fishing plans and recreational activities to control invasive species.
- Organization of volunteering programmes and improvement of river monitoring to

Photo 33
Clean up of solid waste from our water courses

control encroachment on the Hydraulic Public Domain.

A series of rehabilitation and restoration actions is currently being defined and developed within the framework of this Strategy, which may be organized into the following categories:

- Improvement of habitat for fauna.
- Improvement of water quality.
- Improvement of the composition and structure of vegetation.
- Improvement of lateral connectivity.
- Improvement of channel continuity.
- Improvement of the hydrological regime.
- Clean up of river channels and banks.
- Removal of invasive species.
- Recovery of watercourses.
- Morphological recovery.
- Wetland restoration.
- Public use and recovery of historical heritage.

In addition to these project categories, there will be preliminary general studies covering the whole basin area, as an extension of the analysis of impacts and pressures (Impress) that are currently underway. Their purpose will be to identify small-sized infrastructures crossing the main channels, analyse their usefulness, historical, artistic and environmental value, and proceed to their enhancement or make them passable if it is environmentally appropriate.

Up to now, the Basin Organizations have identified numerous projects that are susceptible of being included in this Strategy. At the moment, each Basin Organization is developing and drafting numerous restoration projects which may be looked up in the webpage of the Ministry of the Environment and Rural and Marine Affairs.

Photo 34

Coordination meeting between different agents involved in the conservation of our rivers. Ibor River (Cáceres)

7.4

Volunteering Programme in Rivers

The Volunteering Programme intends to encourage public participation in river management processes, and share the responsibility for their ecological status between competent authorities, citizens´ habits and behaviour, and the interests of the most relevant economic and social stakeholders in each drainage basin.

Within this Programme, projects will focus on the three main lines of action of the National Strategy: Education and Training, Conservation and Protection or rivers and Restoration and Rehabilitation.

a) *Education and Training*

Volunteering can play an important role in education and training aspects, by developing courses and publications targeted to different technical levels, information campaigns, and recreational and cultural activities with a potential for communication and dissemination of information greater than other official channels (e.g. Universities, Professional associations, Basin Organizations, etc.) of a more official or regulated nature.

b) *Conservation and Protection*

Volunteers may also, with financial support to carry out surveillance, monitoring, data recording activities, etc. participate and contribute meaningfully to river conservation projects, to raise awareness in neighbouring residents and to protect habitat and species. There are great opportunities and flexibility to engage groups with physical and mental disabilities in such tasks, in collaboration with local governments, financial entities, foundations, etc.

c) *Restoration and Rehabilitation*

Finally, as part of the Volunteering Programme it would be advisable to create a line of work focused on participation in the restoration and rehabilitation of river channels, always

Photo 35
Workshop on river ecology

in compliance with current health and safety regulations, and by no means intending to replace professionals in their duties. The following actions may be supported:

– Creation of neighbourhood associations to recognize the environmental value of rivers and to design plans to improve their environmental status, recommending to the responsible administration the activities to be carried out.

– Clean up and removal of rubbish and undergrowth from water courses.

– Habitat enhancements to support the natural regeneration of native species.

– Control of invasive species and detection of causes of their proliferation.

– Upgrading infrastructures for the use and enjoyment of rivers.

– Setting up information signs, and document and showcase the value of river landscapes.

– Restoration of small-sized infrastructure of cultural heritage, and recovery of traditional customs related to rivers

– Environmental monitoring, reporting of violations and detection of new pressures and impacts.

– Surveys on different issues affecting rivers.

The webpage of the Ministry of the Environment and Rural and Marine Affairs contains detailed information on all activities underway, including links to the webpages of all the associations involved since the beginning of the programme.

Photo 36

Removal of canes, one of the tasks carried out by volunteers in rivers

7.5

Administrative Coordination and Public Participation Activities

This Programme includes the actions considered necessary to implement the National Strategy for River Restoration that have not been considered in the Programmes already described, dealing with administrative organization and the involvement of social partners that are most significant in terms of pressures and impacts on rivers in Spain.

7.5.1. Identification of agents involved in river management and restoration.

Taking into account the existing administrative structure involved in the management of rivers and their resources, and considering the need for management processes that are multidisciplinary and consider multiple river uses, to broaden the concept of the Hydraulic Public Domain and its monitoring, to have greater flexibility to allow agreements with nearby residents and individuals, and to increase coordination between different administrations, some actions are proposed to speed up the process of change in the way rivers are managed:

The National Strategy must reinforce river management at the scale of the drainage basin, strengthening the current structure and responsibilities of Basin Organizations, and coordinating with other administrations through the mechanisms established in River Basin Management Plans. The participation of Basin Organizations in matters of agricultural and rural development, urban planning, planning of transportation and industrial infrastructure, regional land use, protected area management, granting of subsidies, etc. must be made more operational and be binding.

To facilitate these efforts, and independently of the actions already mentioned, there will be a process of identifying within each administration those agents involved in river management and restoration, organizing participatory meetings to share knowledge and increase positive synergies between all agents involved.

7.5.2. Encouraging the involvement of social partners.

Economic activities related to irrigation agriculture, production of hydroelectricity, urban development, and construction of new transportation infrastructure are recognized as causing the major pressures and impacts on rivers. It is necessary to reinforce coordination in the planning of such activities with river management, acting on the following aspects:

- Technical advice on improvement of irrigation practices, control of fertilizer and pesticide inputs and integrated environmental management systems for farms and agricultural activities.
- Collaboration with local administrations in the development of urban plans, jointly regulating land use planning in flood-prone areas and strategically evaluating the effects of population increase and impermeabilization of land surface at the scale of the drainage basin.
- Collaboration with power generation companies in order to develop joint programmes of measures for the environmental management of their infrastructures.
- Collaboration with local associations and community groups in the monitoring and protection of rivers, and support the development of cultural or recreational initiatives geared to raising awareness or environmental education at local or regional scales.

7.6

Research, Development and Innovation

In September 2008 the Government approved the National Plan on Scientific Research, Development, and Technological Innovation 2008-2011 of the State General Administration.

Contemplated as the Plan on Scientific Research and Technological Development in the Science Law (Ley de la Ciencia, 13/1986), and termed since the year 2000 National Plan on Scientific Research, Development, and Technological Innovation, it is the mechanism to establish new objectives and priorities in research and innovation policies in the medium term, as well as to design new instruments to ensure their achievement. In the period 2008-2011 the Plan´s funds will double those of the previous four-year period, investing over 47 700 million euros, and improving the management of funding programmes.

Within this Plan, the Ministry of the Environment and Rural and Marine Affairs is promoting several actions of R&D&I, through its own research, as well as with specific research and development agreements with Universities, Companies, and other Public Entities.

Photo 37

Bioengineering work by the Water Commission (Comisaría del Agua) of the Cantabric Basin Organization on the Cadagua River, Municipal District of Valle de Mena (Burgos)

CHAPTER 8 SUMMARY AND FUTURE OF THE NATIONAL STRATEGY FOR RIVER RESTORATION


AULA del RÍO

8

Summary and Future of the National Strategy for River Restoration

As a summary, we may say that the National Strategy for River Restoration must encompass a series of actions designed to achieve as an ultimate goal the enhancement of the ecological status of rivers, undertaking the conservation of scenic rivers and reference reaches, the restoration of a large part of the Spanish river network, and the rehabilitation and upgrading of those stretches considered highly modified.

Figure 7 summarizes the principles and concepts that have been presented, serving as a guide to evaluate the accomplishments of each of the stages presented previously in Figure 2.

This set of actions promoted from their inception by the Ministry of the Environment and Rural and Marine Affairs must be integrated within the water planning processes of the Basin Organizations.

In order to realize these accomplishments, it will be necessary to have improved the training, the mechanisms of public participation and involvement, the creation of multidisciplinary teams and the capacity to carry out the projects by establishing collaborations and sharing responsibilities and jurisdictions.

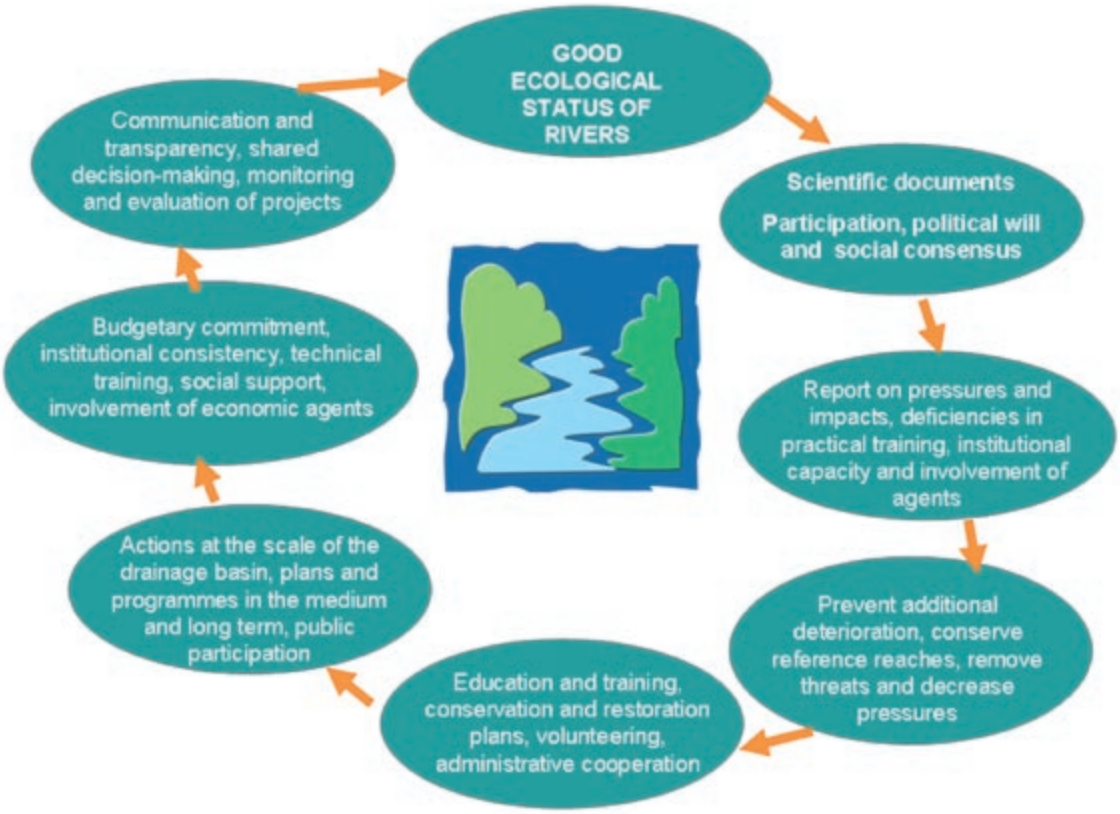

Figure 7

Content of the proposed consecutive stages in the development of the National Strategy for River Restoration

It will also be necessary to have created mechanisms to evaluate and monitor the work done, and to have promoted research and creativity to review the established strategy and design new alternatives, evolving with environmental issues and challenges, and the collective capacity of the Spanish society to deal with them.

Finally, we should point out that these initial action proposals within the National Strategy for River Restoration are initiatives of the Basin Organizations supported by a team from the Ministry of the Environment and Rural and Marine Affairs; however, we emphasize that the work proposed will be analysed by an interdisciplinary technical team, to harmonize and enrich the proposals as a preliminary step to their inclusion into River Basin Management Plans, and within them, to the public participation process where they will be discussed jointly with other aspects of water planning. This process will result in the final restoration measures that will be part of the Programmes of Measures of the River Basin Management Plans.

Photo 38

The work stemming from the National Strategy for River Restoration arises from an analysis and evaluation by multidisciplinary teams which, in turn, are part of a common framework of public participation


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