Órbigo River ecological status improvement, Spain

Year of issue

2025

Summary

Órbigo River (Duero Basin, NW Spain) ecological status improvement. A bundle of sponge measures - levee removal/set-back, rip-rap removal, recovery of secondary channels, floodplain reconnection, natural bank stabilisation, and riparian buffer restoration - was implemented under the WFD and Floods Directive; the project was a 2013 IRF European Riverprize finalist.

Section I (upper ~23.5 km) was built in 2011–2013: ≈4.72 km of rip-rap and 8.71 km of levees were removed, 3.13 km set back, ~10 km of side channels reopened, and ~300 ha of floodplain reconnected; limited works followed in Sections II–III. The Alcoba weir was modified by cutting a central notch (~15–16 m) with seasonal removable boards and a ramp to restore fish passage and sediment/nutrient continuity, reconnecting ~25 km of river.

Post-project assessments report increased channel dynamism and sinuosity and riparian vegetation regeneration - moderate effectiveness in the short term, underscoring the need for long-term monitoring. Overall, actions improved lateral and longitudinal connectivity and enhanced natural flood attenuation; AdapteCCa summarises ~480 ha of floodplain now functioning with the river.

Photo Gallery



Location

42.65652004, -5.82061595

Project

NWRM

National ID

Spain_02

Sector

Hydromorphology

Installation Date

2012

Implementation status

Completed

Contact

Gonzalo Delacámara and Marta Rodríguez (IMDEA Water) in close cooperation with Ignacio Rodríguez Muñoz, José Ignacio Santillán Ibáñez and Rosa Huertas (Duero River Basin Authority, Confederación Hidrográfica del Duero)

Overview

Location of the project

This application has been implemented in a 23.5 km long stretch (stretch I) of the Órbigo River (Duero River Basin) located in the northwest of Spain.

Country

Spain

NUTS2 Code

Castilla y León

Sponge measures implemented in the case study

Floodplain restoration and management

Forest riparian buffers

Removal of dams and other longitudinal barriers

Natural bank stabilisation

Elimination of Grey River Bank Protection

Stream bed re-naturalisation

Objectives

Project-wide aims (108 km): restore lateral connectivity (remove/set back levees/riprap, reopen floodplain/secondary channels), improve longitudinal connectivity (permeabilize weirs, notably Alcoba), and restore riparian buffers and dynamics, integrating WFD and Floods Directive goals.

Involved partners

Authority type	Authority name	Authority role	Comments	Authority responsibility
National water authority	Ministry of Environment and Rural and Marine Affairs (Ministerio de Medio Ambiente, Medio Rural y Marino), MARM	Initiation of the measure	Providing a general framework (drawing up the National Strategy on River Restoration, ENRR) in which this initiative can take place)	Responsible

Authority type	Authority name	Authority role	Comments	Authority responsibility
Regional / sub-national water authority	River Basin Authority (Confederación Hidrográfica del Duero)	Determination of design details of the measure	Selecting a candidate project to be developed within the framework of the National Strategy on River Restoration. Selection criteria based on IMPRESS, Methodological Guide on River Restoration and priority areas aimed at improving connectivity	Responsible
Regional / sub-national water authority	River Basin Authority (Confederación Hidrográfica del Duero)	Implementation	Preparatory, diagnosis, public hearing process and works	Responsible
National water authority	Ministry of Environment and Rural and Marine Affairs (Ministerio de Medio Ambiente, Medio Rural y Marino), MARM	Implementation	Participation during preparatory, diagnosis, public hearing process and works	Responsible
Other	Municipalities (Ayuntamientos): Cimanes del Tejar, Llamas de la Ribera, Carrizo de la Ribera, Turcia and Santa María del Rey	Implementation	Participation during preparatory, diagnosis and public hearing process	Supporting
Other	Local entity (Juntas vecinales)	Implementation	Participation during preparatory, diagnosis and public hearing process	Supporting
NGO	Neighbourhood associations	Implementation	Participation during preparatory, diagnosis and public hearing process	Supporting

Authority type	Authority name	Authority role	Comments	Authority responsibility
National water authority	Ministry of Environment and Rural and Marine Affairs (Ministerio de Medio Ambiente, Medio Rural y Marino), MARM	Financing	Within the framework of the National Strategy on River Restoration	Supporting
Regional / sub-national water authority	River Basin Authority (Confederación Hidrográfica del Duero)	Monitoring	—	Supporting

Documents

cs-es-02-final_version.pdf (1.65 MB)

Site Information

Climate Zone

Warm temperate dry

Precipitation

535.00 mm

Temperature (°C)

10.70 °C

Elevation range

900 m

Slope range

0-1% (average slope of the Órbigo River Stretch I: 0.3%)

Vegetation class

Riparian vegetation with poorly preserved continuity due to replacement with other uses (adjacent crops: agro (irrigation) and forest (poplar: Populus x euroamericana).

WFD Ecological status

Good

WFD Chemical status

Good

Water quality status

All good : Oxygen: 9.79 mg/l, pH: 7.71, Ammonium: 0.05 mg/l, BOD5: 2.00 mg/l, Nitrate: 1.12 mg/l, Diatom index: EQR IPS 2007: 1.17 , Macroinvertebrates EQR IBMWP: 1.53.

Design and Implementation

Project scale

Meso

Project scale specifications

Length of the stretch to be improved by means of this specific project: 23.5 km. Area: around 45 ha.
In the near future (already passed environmental and technical assessment and pending to obtain funding) similar projects will be carried out in downstream stretches (segment II: 27.5 km; and segment III: 57.8 km)

Project area

160500

Area subject to Land use change or Management/Practice change (ha)

45.00 ha

Size

45.00

Size unit

ha

Financing

Total cost

3084697.25 €

Total cost information

This is the total projected budget. Budget breakdown: 1. Lateral connectivity and dynamics improvement works (52.01%); 2. Longitudinal continuity improvement works (15.70%); 3. Riverbank estabilization works (7.52%); 4. Site access improvement (11.14%); 4. Supplementary works (2.57%); 5. Other items: monitoring of works (3.89%); environmental monitoring (3.89%); risk prevention (2.23%); waste management (1.06%)
Executed budget: 2065264.81 €

Costs land acquisition information

Null value as intervention were carried out in Public domain land

Costs operational information

Commonly no operational cost is associated to this kind of project (river restoration) [Source: García et al. (2013)]

Costs maintenance information

Variable according to the specific element considered (average values for Spanish river basins: 1.2% of initial investment cost for fishladders; 20% of total investment cost for revegetation works; 15% of total investment cost for bioengineering works). Due to the implementation of the project maintenance costs have been drastically reduced. These costs were expected to be very low and assumed by the Duero River Basin Authority within the framework of its Public Domain Conservation Programme

Financing authorities

Authority name	Type of funding	Comments	Financing share
Ministry of Environment and Rural and Marine Affairs (Ministerio de Medio Ambiente, Medio Rural y Marino), MARM	National funds	This measure is implemented within the framework of the National Strategy for River Restoration (ENRR, Estrategia Nacional de Restauración de Ríos).	100 %

Compensations

No

Policy and Governance

Policy description

The municipalities of Cimanes del Tejar, Llamas de la Ribera, Carrizo de la Ribera, Turcia and Santa Marina del Rey located by the Órbigo River (León province, Castilla y León Region) were suffering from the effects of hydromorphological (weirs, channels…) and land-use patterns change pressures for this water body: loss of lateral (main derived problem: floods) and transversal connectivity, river dynamics (derived problems: erosion and sedimentation) alteration, flow alteration and riparian forest loss and fragmentation.

Land ownership

Public land.

Policy targets

Peak-flow reduction

Runoff control

Erosion Control

Improved Biodiversity

Oher Societal Benefits

Target remarks

Flood control and flood risk mitigation. As a final aim. Recovering morphology and hydraulic capacity of the former stream bed of the river and its connectivity with the floodplain and improving longitudinal continuity (by means of works to 1) improve lateral connectivity and dynamics; 2) improve longitudinal continuity; 3) forest actions (revegetation)
Mass stabilisation and control of erosion rates.
Biodiversity and gene-pool conservation in riparia. More accurately: improve ecological status of the river.

Policy pressure

Directive	Relevant pressure
Floods Directive identified pressure	Natural Exceedence
Floods Directive identified pressure	Blockage / Restriction
WFD identified pressure	4.1.1. Physical alteration of channel/bed/riparian area/shore of water body for flood protection
WFD identified pressure	4.2.2. Dams, barriers and locks for flood protection

Pressure remarks

Loss of lateral (main derived problem: floods) and transversal connectivity, river dynamics (erosion and sedimentation) alteration, flow alteration and riparian forest loss and fragmentation. Pressures for this water body (identified by IMPRESS): hydromorphological (weirs, channels...) and land-use patterns.

Policy impact

Directive	Relevant impact
Floods Directive identified pressure	Waterbody status (adverse permanent or long-term consequences ecological or chemical status of surface water bodies or chemical status of ground water bodies affected, as of concern under the WFD due to the hydromorphological impacts of flooding)
Floods Directive identified pressure	Infrastructure (adverse consequences to infrastructural assets such as utilities, power generation, transport, storage and communication)
Floods Directive identified pressure	Other environmental impacts: other potential permanent or long-term adverse environmental impacts, such as those on soil, biodiversity, flora and fauna, etc.
WFD identified pressure	Altered habitats due to morphological changes
WFD identified pressure	Altered habitats due to hydrological changes

Requirement directive

Requirement directive	Specification
Floods Directive-mitigating Flood Risk	By means of measures aimed at giving river more space
WFD-achievement of good ecological status	By means of measures aimed at improving the hydromorphological conditions of the water body (river continuity and morphological conditions, mainly)

Policy challenges requirements

National Strategy for River Restoration (Estrategia Nacional de Restauración de Río, ENRR), Sub-programme 3 (improvement of the longitudinal continuity of the rivers within the Duero basin) and 4 (improvement of the lateral continuity of the rivers within the Duero basin)

Part of a wider plan

Yes

Wider plan

Wider plan type	Wider plan focus	Name	Comments
National	Water	National Strategy for River Restoration (Estrategia Nacional de Restauración de Río, ENRR)	Sub-programme 3 (improvement of the longitudinal continuity of the rivers within the Duero basin) and 4 (improvement of the lateral continuity of the rivers within the Duero basin) [Source: Rodríguez et al., 2012a]

Public consultation

Yes

Consultation activities

Activity stage	Activity type	Key issues	Comments
Screening phase	—	Preparatory phase (year 2009): with municipal majors/neighbourhood associations'representatives. Using ortophotos (years 56-57, 2004 and 2008) as a basis for analysing changes in floodplain	—
Design phase	—	a) Diagnosis phase (year 2009): Compilling and analysing information provided by the referred stakeholders; b) Informative sessions: with other interested stakeholders (inhabitants)	—
Other	—	Public hearing phase (year 2009: alternatives were discussed and showed by means of computer simulation on the basis of ortophotos (years 2004 and 2008).	[CHD, 2013b]: More than 50 meetings (in a period of 3 years) with stakeholders.
Other	—	Monitoring	[Source: Barquero and Santillán (2012a)]
Design phase	—	Informative sessions (for stakeholder (inhabitants)	—

Activity stage	Activity type	Key issues	Comments
Implementation phase	—	a) Informative sessions (for stakeholder (inhabitants); b) Dissemination activities (for external audience) and field trips: Riverbasin Authority/Ministry of Environnment Websites; Specialised national/international networks on river restoration (newsletters, presentations). 2013 IRF European Riverprize finalist practice.Field trips from: Universities, Administration bodies, within in the framework of specialised workshop; c) Newspapers; d) Volunteering and environmental education programme	—
Screening phase	CONSULTATION ACTIVITIES	Preparatory phase (year 2009): with municipal majors/neighbourhood associations'representatives. Using ortophotos (years 56-57, 2004 and 2008) as a basis for analysing changes in floodplain	—
Design phase	CONSULTATION ACTIVITIES	a) Diagnosis phase (year 2009): Compilling and analysing information provided by the referred stakeholders; b) Informative sessions: with other interested stakeholders (inhabitants)	—
Other	CONSULTATION ACTIVITIES	Public hearing phase (year 2009: alternatives were discussed and showed by means of computer simulation on the basis of ortophotos (years 2004 and 2008).	[CHD, 2013b]: More than 50 meetings (in a period of 3 years) with stakeholders.
Other	CONSULTATION ACTIVITIES	Monitoring	[Source: Barquero and Santillán (2012a)]
Design phase	COMMUNICATION	Informative sessions (for stakeholder (inhabitants)	—

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Has contractual arrangements

No

Impacts and Monitoring

Monitoring System

Monitoring requirements

This works are assumed by the Duero River Basin Authority

Monitoring parameters

So far: areas suffering from intense erosion and deposition processes; side arms dynamics according to variable water flow levels; wet areas after intense flood events (April 2013 and 2014) and perception of local population towards changes. Planned new activities to be carried out during 2014: topographic characterization of the most active areas.

Maintenance

Maintenance requirements

Channel : natural and dumped debris regular removal; removal of excessice or dead vegetation, sediment removal. Shoreline regular inspection and replacement of damaged vegetation when required. Fish ladders: inspection and structure repair/rehabilitation.

Impact Assessment Methodology

Performance impact assessment method

Catchment outlet

Performance impact estimation information

Field visits, drone images (comparison before and after floods), information from stakeholders.

Socio-economic Impacts

Direct benefits

Flood protection (material damage reduction)
Recognition as climate adaptation good practice

Biophysical impacts: Hydrology

Information on retained water

Variable volume of retained water according to circulating water flow and water depth. For this kind of intervention it is more appropriate to use the concept of "slow down flow water" and the use of simulation models (different water volumes and return periods). E.g. Flood lamination: 4-5 hm3; Water volume: 590 m3/s; Return period: 500 years

Information on peak flow reduction

According to the Planning Office (River Basin Authority) (on-going evaluation) NRWM have performed properly against floods that took place during Winter 2013 (160 m3 flood: same as those in 1995 and 2000 causing serious damage) and during the Winter of 2014 (300 m3). These were successfully abated thanks to NWRM [Source: River Basin Authority, personal communication]

Information on increased infiltration

Greater infiltration rate and rate of recharge of the natural floodplains.

Ecosystem flood control volume

160.00 m3

Information on ecosystem flood control volume

According to Planning Office (River Basin Authority) (on going evaluation) these NRWM have performed properly against floods that took place during Winter 2013: 160 m3 flood, (same that in 1995 and 2000 caused serious damage) was successfully abated thanks to implemented NWRMs

Information on Restoring hydraulic connection

Restored transversal and longitudinal connectivity, reopening ~10 km of side channels, and recovery of 300–480 ha of floodplain enhancing natural flood attenuation capacity. The Alcoba modification enables fish migration and sediment/nutrient continuity during non-irrigation seasons (boards removed), reconnecting ~25 km.

Biophysical impacts: Biodiversity

Improved biodiversity

Yes

Information on improved biodiversity

After dismantling levees and revetments along a ~21.6 km segment, the Órbigo showed channel widening and regeneration of riparian vegetation towards more natural willow/poplar communities, evidencing increased dynamism

Biophysical impacts: Water & Soil Quality

Water quality overall improvements

Not relevant for this application

Information on water quality overall

According to technical project, initial water quality status for the Stretch I (chemical/physical status /microinvertebrates/diatomes) was rated as good-very good so no specific measures were designed for this purpose. Despite of this, first evaluation results show that the ecological status of this water body has been improved.

Soil quality overall improvements

N/A info

Information on soil quality overall improvements

Positive effects regarding infiltration rate and rate of recharge of the alluvial natural floodplains and soil fertilization are expected but no empirical evidence has been obtained yet [Source: CHD (2013b]]

Information on soil quality, overall soil carbon

Positive impact-SQ improvement

Ecosystem erosion control

Yes

Biophysical impacts: Others

Ecosystem impact climate regulation

No information available

Lessons Learned

Key lessons

A 2013 IRF European Riverprize finalist.
a) Good practice of integrated water management and land use policies
b) Implementation of innovative concepts (e.g. “room for the river”, green infrastructure...)
c) Relevance of management and planning tasks.
d) Example of integrated approach in WFD and FD implementation
e) Example of the need to devote a great deal of time and effort to explain to the stakeholders the scope of the measures in order to achieve their acceptance and their participation. Multiplier effects are obtained when stakeholders became aware of the effectiveness of the measures.
e) Example of the relevance of public involvement during the whole process (public participation during the planning cycle and volunteering within the framework of environmental programme linked to the Project).
f) Impact on the media (beyond the pressnotes on the plan).
g) Replicability (downstream stretches) potential and networking potential (the project derived in the participation of the Basin Authority -together with other 4 European basin authorities- in the ECRR Community of Practice -launched in 2013 as a network for sharing their experiences in river restoration).

Barriers

Barrier type	Barrier role	Comments
Attitude of relevant stakeholders	Main barrier	At first, local population was relunctant to the implementation of the project. Reasons: they didn't understand the theory (intervention was very different -aim was to create "room for the river"- to anything else carried out previously in the river) and how it would work in practical terms. [Source: CHD (2013a]]

Drivers

Driver type	Driver role
Past flooding events	Main driver
Organisation committed to it	Main driver

Success factors

Success factor type	Success factor role	Comments
Public participation	Main factor	Active participation process during the whole life-cycle of the project
Attitude of decision makers	Main factor	Innovative approach, strong involvement and will to promote participation
Existing staff and consultant knowledge	Main factor	Innovative approach, strong involvement and will to promote participation
Existing institutional framework	Main factor	Coordination between Ministry and River Basin Authority
Financing possibilities	Main factor	—

Cost effectiveness

Structural measures for flood protection traditionally applied in urban river stretches have resulted in very negative effects. Applied approach was assessed to a more cost-effective option than the traditional one.

Sources

Sources

Proyecto para la mejora del estado ecológico del río Órbigo. Tramo I (León). Documento 1_ Memoria (Clave 02.434-229/2111) (Órbigo River ecologic status improvement. Stretch I (León). Document 1 (Technical Report)

Proyecto para la mejora del estado ecológico del río Órbigo. Tramo I (León). Anejo 4 (Estudio hidrológico e hidraíºlico).

Proyecto para la mejora del estado ecológico del río Órbigo. Tramo I (León). Anejo 5 (Estudio morfológico).

Proyecto para la mejora del estado ecológico del río Órbigo. Tramo I (León). Documento 4 (Presupuesto).

Estrategia Naciional de Restauración de Ríos (ENRR). Demarcacion Hidrográfica del Duero

Proyecto para la mejora del estado ecológico del río Órbigo. Tramo I (León). Instrucción para la elaboración y tramitación de los informes de viabilidad previstos en el artículo 46.5 de la Ley de Aguas). [Clave: 02.434-229/2111]

El Proyecto de mejora ecologica del río Órbigo (tramo I)

Case Study: Improvement of the Ecological Status of the River Órbigo (Leon, Spain)

Ecological Improvement Project in the Órbigo River (Stretch I)

The Órbigo River Restoration Project and its implications in flood risk prevention

River Órbigo Restoration Project

Guía técnica para la caracterizacion de las actuaciones a considerar en planes hidrologicos y estudios de viabilidad

NATURA 2000 – Standard Data Form, Site ES4130065 “Riberas del Río Órbigo y afluentes”

Demolición de barreras en el río Órbigo, para recuperar la conectividad ecológica

Dismantling artificial levees and channel revetments promotes channel widening and regeneration of riparian vegetation over long river segments

Resumen ejecutivo - Esquema de temas importantes de la parte española de la Demarcación Hidrográfica del Duero (tercer ciclo de planificación hidrológica)