# DIVAQUA

## IMPROVING AQUATIC DIVERSITY IN PICOS DE EUROPA

With the contribution of the LIFE programme of the European Union

PROJECT

# DIVAQUA LIFE

## The LIFE program

Is an EU financial instrument created in 1992 by the European Commission. The main objective of this program is to contribute to the sustainable development and the attainment of the objectives and goals of the Europe 2020 Strategy, as well as other strategies and plans of the EU in environmental and climate matters. Since the creation of the program until now, LIFE has co-financed 5.500 projects, with a budget of 6.5 billion €.

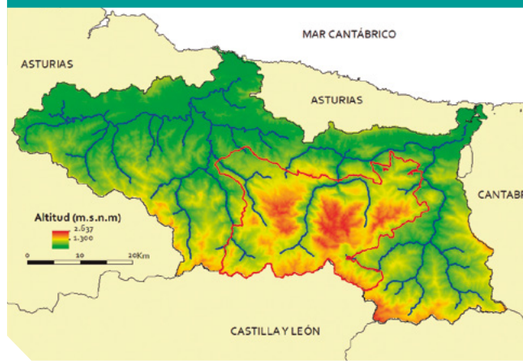
The EU Council Directive (92/43/ECC) relating to habitats and species conservation defines the following terms:

**Habitats of community interest**
Those natural or semi-natural habitats that I) are in danger of disappearing from their natural range, II) have a restricted distribution area and/or III) present outstanding examples of one -or several- of the 9 biogeographical areas defined in the EU.

**Species of community interest**
Those species that are I) in danger, II) vulnerable (in danger in the near future if factors causing threat persist), III) rare (with small populations that could become in danger or vulnerable) and located in limited geographical areas or dispersed in a big area and iv) endemic or they require special attention due to their habitat and/or possible impacts.

## The DIVAQUA LIFE action area

DIVAQUA was developed in Sella and Deva-Cares river basins (northern Spain; 245.000 Ha), in the regions of Cantabria, Asturias and Castilla y León, with special attention to the Picos de Europa National Park. This area contains 7 SAC of the Natura 2000 network.




## The DIVAQUA LIFE Project

The project "DIVAQUA-Improving Aquatic Diversity in Picos de Europa" is a European project provided with 60% co-finance from the European Commission through the LIFE program. The total budget of the DIVAQUA is 2,361,506 €.

### Main restored/protected habitats of community interest in DIVAQUA (* priority habitats)

- **91E0*** Alluvial forests with Alnus glutinosa and *Fraxinus excelsior*
- **7140** Transition mires and quaking bogs
- **7110*** Active raised bogs
- **7220** Petrifying springs with tufa formation
- **7230** Alkaline fens

### Main species of community interest favoured by DIVAQUA

**The fern**
*Woo dwardia radicans*

**Atlantic salmon**
*Salmo salar*

**Long-tailed salamander**
*Chioglossa lusitanica*

**Iberian desman**
*Galemys pyrenaicus*

**Lamprey**
*Petromyzon marinus*

**Other important species favoured by DIVAQUA:**

**Brown trout**
*Salmo trutta*

**Alpine triton**
*Triturus alpestris*

**Trébol de agua**
*Menyanthes trifoliata*

**Peat lizard**
*Lacerta vivipara*

## The DIVAQUA LIFE objectives

**01** Reduce human pressures for improving the conservation status of aquatic habitats and species of community interest and increase the ecosystem services provision.

**02** Promote the sustainability of the socioeconomic activity of the area.

**03** Develop new tools and approaches to improve the characterization, monitoring, evaluation and management of aquatic ecosystems, species and habitats.

**04** Promote the creation of networks to advance in the knowledge and improvement of management and conservation of mountain aquatic ecosystems.

# Harmonic cohabitation

The LIFE DIVAQUA project aims for the harmonious coexistence between human activity and the preservation of mountain aquatic ecosystems, along with the biodiversity and ecosystem services associated with these aquatic environments.

**/ Biodiversity conservation**
**/ Social awareness**
**/ Sustainable management**
**/ Economic activity**

| PRESSURE/PROBLEM | SOCIOECONOMIC ACTIVITY | AFFECTED ELEMENTS | DIVAQUA ACTIONS & SOLUTIONS |
|---|---|---|---|
| Lack of information for management and conservation | Management | Protected aquatic elements and processes | **01** Field campaigns and deployed sensors for continuous data collection.<br>**02** Implementation of new techniques for biological characterization (eDNA).<br>**03** Implementation of new approaches for physical and biological characterization (remote sensing).<br>**04** Development of predicting models. |
| River discontinuity by hydraulic infrastructures | **01** Hydroelectrical<br>**02** Old concessions (e.g. mills)<br>**03** Cattle farming | **01** Fishes<br>**02** Ecological processes<br>**03** Fluvial ecosystems services | **01** Removal of obsolete/unused weirs.<br>**02** Construction of new fish passages.<br>**03** Adaptation and improvement of existing fish passages and channels. |
| Water quality degradation | **01** Old mining<br>**02** Cattle farming<br>**03** Tourism | **01** Aquatic communities<br>**02** Amphibians<br>**03** Ecological processes<br>**04** Fluvial ecosystem services | **01** Runoff reduction.<br>**02** Protection of springs, lakes and wetlands.<br>**03** Riparian restoration (91E0* & new colonies of *W. radicans*).<br>**04** Adaptation and improvement of cattle troughs and water tanks. |
| New diseases and alien species propagation | **01** Cattle farming<br>**02** Tourism | Biological communities, especially amphibians | Implementation of new techniques for biological characterization (eDNA). |
| Lack of social awareness | **01** Local population<br>**02** Farmers<br>**03** Tourism | Mountain aquatic ecosystems and their biological and physical elements, services and processes | **01** Workshops with experts in different areas.<br>**02** Conservation activities with volunteers.<br>**03** Dissemination of main results (conferences, congresses).<br>**04** Audiovisual material (videos, illustrations, social-media). |

# Recovering the continuity of the fluvial ecosystem by acting on hydraulic infrastructures

## 01 WEIR REMOVAL

### Unused weirs with expired usage concession in the Deva-Cares basin

#### PUENTELLÉS

> Used to deviate water to an old mill.
> This weir changes the migratory patterns of salmons and lampreys.
> Removed in september 2022.
> Weir: Concrete, 1.5 m high.
> Location: Deva river; Asturias.
> This action frees up 21 km of river channel.

#### OJEDO

> Used to deviate water to an old foundry.
> This weir does not have a fish passage, limiting the upper distribution of salmon in this river.
> Removed in september 2021.
> Weir: Masonry, 2.6 m high.
> Location: Bullón river; Cantabria.
> This action frees up 20 km of river channel.

#### TAMA

> Used for orchards irrigation.
> This weir does not have a fish passage. In low flow periods the pass for fishes was very difficult.
> Removed in october 2023.
> Weir: Concrete, 0.7 m high.
> Location: Deva river, Cantabria.
> This action frees up 21 km of river channel.

#### POTES

> Used for hydropower energy generation.
> This weir does not have a fish passage, limiting the upper distribution of salmon in this river.
> Removed in september 2022.
> Weir: Masonry, 2.5 m high.
> Location: Deva river; Cantabria.
> This action frees up 22 km of river channel.

## 02 ADAPTATION OF HYDRAULIC INFRASTRUCTURES

### Hydraulic infrastructures used for hydroelectric power generation

#### PONCEBOS DAM

> Problem: the access to the fish-passage was not satisfactory.
> DIVAQUA solution: Improve the connection between river channel and the fish passage by changing the structure of the lowest part of the fish passage.
> Done in september/october 2022.
> Location: Cares river; Asturias.

#### URDÓN DAM

> Problem: the fish passage had not enough flow for fish attraction.
> DIVAQUA solution: Increase the flow upstream of the fish passage by drilling the diversion channel.
> Done in august 2023.
> Location: Urdón river; Cantabria.

#### RESTAÑO DAM

> Problem: dam without fish passage.
> DIVAQUA solution: the construction of a new fish-passage.
> Done between november 2023 and march 2024.
> Location: Dobra river; Asturias.

#### CAMARMEÑA CHANNEL

> Problem: the entry of fishes and other animals into the channel by its mouth and by the exposed middle part of the channel causing animal death.
> DIVAQUA solution: 1) Installation of a fish deterrent barrier in the channel mouth and 2) Concrete filling of the exposed part of the channel to prevent wild animals from entering.
> Done 1) may 2022 and 2) december 2021.
> Location: Castilla y León y Asturias.

# Improving water quality and the conservation status of mountain aquatic habitats and species of community interest

## 01 Reducing the runoff processes from the sediment pond of the old mine of Las Mánforas (2.7 Ha) to the Duje river source

### SOLUTIONS

Reconstruction of an old dam between the sediment pond and the river source for sediment retaining.

Installation of a livestock fence to avoid the entrance of cattle (cows) to the mine sediment pond.

### RESULTS

Improving river water quality and river hydromorphological conditions.

Revegetation of an old mine sediment pond and improve river conditions.

### MAIN OUTCOMES

Retention of 250 m3 of sediment during the first year since dam construction, avoiding its entrance in the river channel.

Allow the development of vegetation in the sediment pond to reduce the runoff processes in the future.

## 02 Protecting mountain wetlands affected by cattle farming and tourism (trampling, water enrichment, vegetation degradation)

### SOLUTION

Installation of a perimeter fencing in:

- 2 lakes: La Mina and Ercina (Asturias)
- 1 spring in Vega Comeya (Asturias)
- 4 mires in Las Salgardas (Cantabria), Vegabaño (Castilla y León) and Vega Comeya (Asturias)

### RESULTS

Avoid the entrance of cattle and people in these aquatic ecosystems

### MAIN OUTCOMES

- Improvement of water quality
- Development of aquatic plants and animal communities.
- Improvement the conservation status of several habitats of community interest: 7140, 7110*, 7220, 7230.

# 03 Improving the conservation status of riparian habitats (91E0*) and species (*W. radicans*) of community interest

## SOLUTIONS

Restore the riparian forest in a Cares river stretch (1.5 km) by using structuring species of the habitat 91E0*, such as alders (*Alnus glutinosa*), ash trees (*Fraxinus excelsior*), hazelnut trees (*Corylus avellana*).

Increase the number of colonies of the community interest fern *Woodwardia radicans.*

## RESULTS

Development of the EU priority riparian forest 91E0* in a river stretch affected by goat browsing and fires.

Creation of 6 new colonies of *W. radicans* in the DIVAQUA area. These colonies were created with new plants (>100) cultivated from bulbils of natural populations of this species.

## MAIN OUTCOMES

> Improving the conservation status of the habitat 91E0* by increasing its distribution area.

> Improving the ecological conditions of the Cares river by increasing the river thermal regulation capacity, the diversity of conditions and sediment retention.

Improving the conservation status of *W. radicans* by increasing its distribution area and population size.

# 04 Adapting small water infrastructures for amphibian reproduction

## SOLUTION

Implement an ad hoc design for cattle troughs and water tanks to prevent desiccation and assure water availability for successful amphibian reproduction and larval development.

## RESULTS

> Install a bucket inside the cattle troughs to prevent livestock from accessing and drying them out.

> Installing ramps to allow the entry and exit of amphibians from the cattle troughs and water tanks.

> Repair these infrastructures when necessary to make compatible their use with conservation objectives.

## MAIN OUTCOMES

> Adaptation of 18 cattle troughs to allow their use for cattle along with amphibian conservation and reproduction.

> Adaptation of 11 water tanks to make them suitable for firefighting while ensuring the conservation of amphibians.

# BIVAQUA

# Increasing our knowledge to manage and protect mountain aquatic ecosystems

- Seasonal field campaigns in >100 sites (2020 and 2021) for water quality and aquatic biological (eDNA technique) characterization.
- Summer field campaigns in 13 river sites for a comprehensive ecosystem characterization (biological communities, ecological processes, etc.).
- Data loggers in 8 sites to continuous monitoring of water level and temperature.
- Development of climatic and ecological data bases (precipitation, temperature, etc.).
- Remote sensing information for physical characterization, including LiDAR and satellite (Landsat 8, Sentinel 2).
- Development of a common cartography.
- Ecosystem services assessment.
- Cartography of key species, pathogens and invasive species.
- Heavy metal concentrations in aquatic ecosystems surrounding former mining areas.
- Proposal of environmental flows for Sella and Deva-Cares basins.
- Model of hydrological conditions and climatic parameters under different climate scenarios.

# Why is this necessary? Is important to know what, where and why for understand the present and adapt to the future.

## Identifying where and why we have environmental problems

- Water quality problems
- Problems with “unwanted organisms”, such as alien species or pathogens
- Problems with ecosystems services, such as runoff processes or water supply, relating supplier and beneficiary areas.
- Biodiversity decline

## Creating collaborative networks for improve our knowledge

- DIVAQUA served as the catalyst for creating a new node of the Long Term Ecological Research (LTER) network. Moreover, several DIVAQUA study sites have been included in the first Iberian River Observatory (IberRios).
- These networks are necessary to understand socioecological patterns at large spatial and temporal scales.
- These networks are useful for finding joint solutions to common problems.

## Identifying where and why we have relevant environmental elements

- Catalogued species cartography, such as species of community interest
- Habitats of community interest cartography
- Special conservation spots, such thermal aquatic refugees.
- Development of appropriate management plans

## Identifying what are the future challenges

- Define the distribution of aquatic habitats and species under different future scenarios.
- Determine the ecosystem services under different future scenarios...We will have water enough in the future?
- Adaptation measurements for the future... towards the socioeconomic development and nature conservation.

# The success of DIVAQUA is also related with

## Project compensatory measures

In order to avoid problems with local population, territory uses and other socio-economic agents, all the conservation measures of DIVAQUA were presented and agreed with:

> Local and regional Governments.

> Land and infrastructure owners.

> Professional associations, such as livestock farmers and hoteliers.

> Confederación Hidrográfica del Cantábrico.

To reduce the impact of DIVAQUA actions on the activity of livestock farmers (e.g. wetland fencing) we implemented several compensatory measures:

> Construction of 4 mountain cattle yards.

> Clearing scrubs and bushes in several mountain areas to promote the growth of grass. These compensatory measures were done by using an appropriate method, leaving patches of uncleared vegetation.

## Project dissemination strategy

> 90 publications: 8 printed editions, 72 digitals, 7 radio and 3 TV.

> Publication of 14 quarterly informative bulletins.

> Conducting 4 volunteer workshops.

> IlustraCiencia workshop for creating artistic sheets of species and aquatic habitats in collaboration with the MNCN-CSIC.

> Organization of 8 events related with the conservation of mountain aquatic ecosystems. All the events where organized in the DIVAQUA area.

> Recording of 4 videos presenting the DIVAQUA project (see www.youtube.com/@lifedivaqua6318).

> Use of social media and website (https://lifedivaqua.com/; 35.000 visits) to update the actions of the project.

> Installation of informative panels at different places. These panels include QR codes to inform visitors about the importance of conserving these aquatic ecosystems.

> Presentation of the project and its main results in different national and international congresses and events.

DIVAQUA
MEJORANDO LA
**DIVERSIDAD ACUÁTICA**
EN PICOS DE EUROPA



# DIVAQUA

IMPROVING
**AQUATIC DIVERSITY**
IN PICOS DE EUROPA



With the contribution of the LIFE programme of the European Union

More information:
www.lifedivaqua.com
info@lifedivaqua.com
+34 621 348 838

**lifedivaqua**
**@lifedivaqua6318**