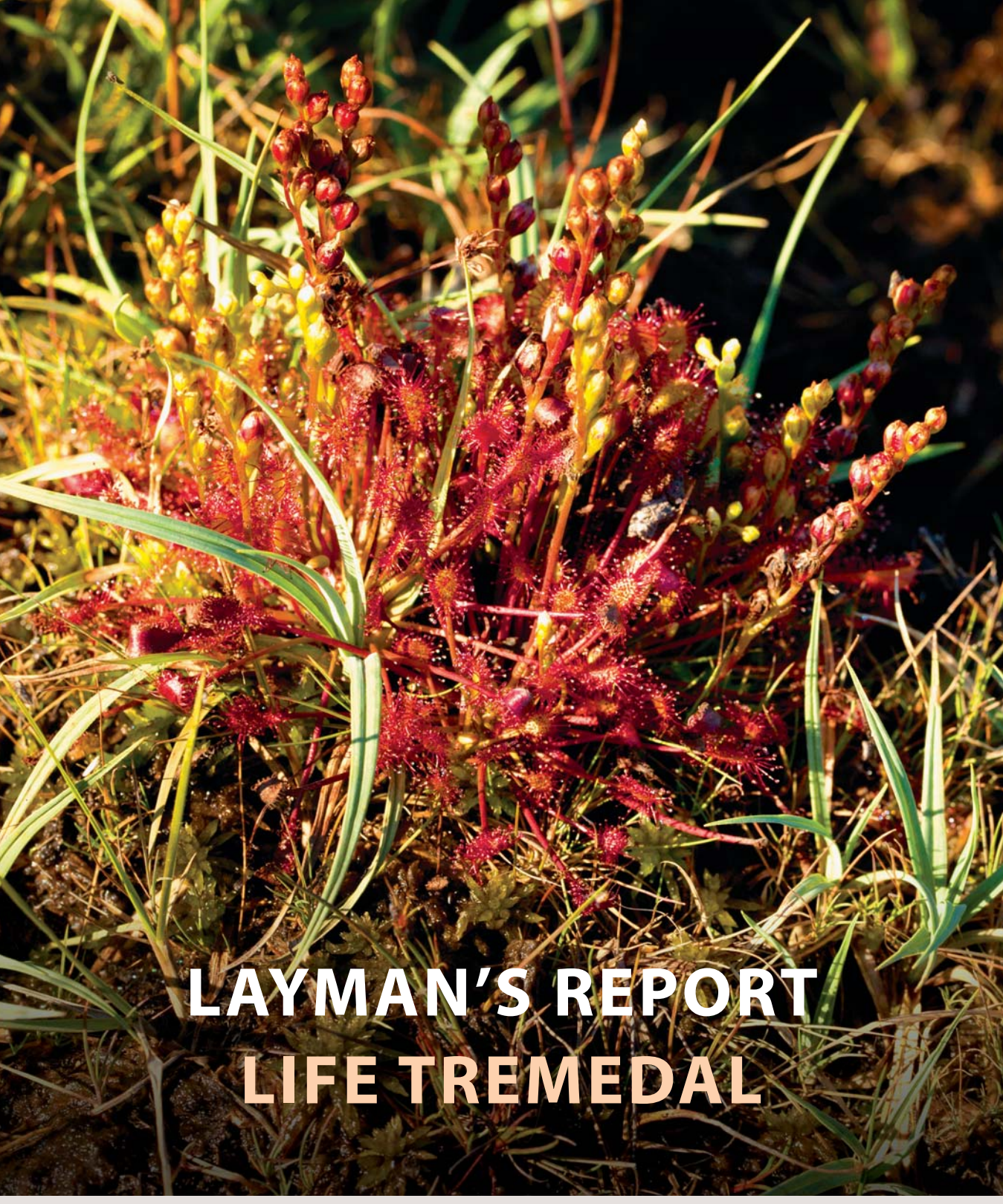

LAYMAN'S REPORT
LIFE TREMEDAL

LIFE · TREMEDAL

Life

NATURA 2000

Title: Inland wetlands of the Northern Iberian Peninsula:
management and restoration of peatlands and wet environments

Published by: LIFE Tremedal Team

Reference: LIFE11 NAT/ES/707

Legal Depositary: NA 1016-2016

LAYMAN'S REPORT

LIFE·TREMEDAL

Inland wetlands of the Northern Iberian Peninsula: management and restoration of peatlands and wet environments

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Life

NATURA 2000

LIFE·TREMEDAL

LAYMAN'S REPORT

TREMEDAL: A PROJECT FOR THE MANAGEMENT AND RESTORATION OF INLAND WETLANDS ON THE NORTHERN IBERIAN PENINSULA.

Title: "Inland wetlands of the Northern Iberian Peninsula: management and restoration of peatlands and wet environments".

Abbreviation: LIFE+ Tremedal

Reference: LIFE11 NAT/ES/707

Coordinating beneficiary: Gestión Ambiental de Navarra.

Associated beneficiaries: University of Oviedo, University of Santiago de Compostela, Provincial Council of Alava, Hazi, Picos de Europa National Park and Grupo Tragsa.

With the collaboration of: Government of Navarre, Government of Galicia, Provincial Council of Lugo, Atlantic Botanical Garden of Gijon, Government of the Principality of Asturias, Government of Castile and Leon, Provincial Council of Gipuzkoa, Basque Water Board and the Basque Government.

Total budget: 2.824.867 €

Duration: 1 July 2012 to 31 October 2015.

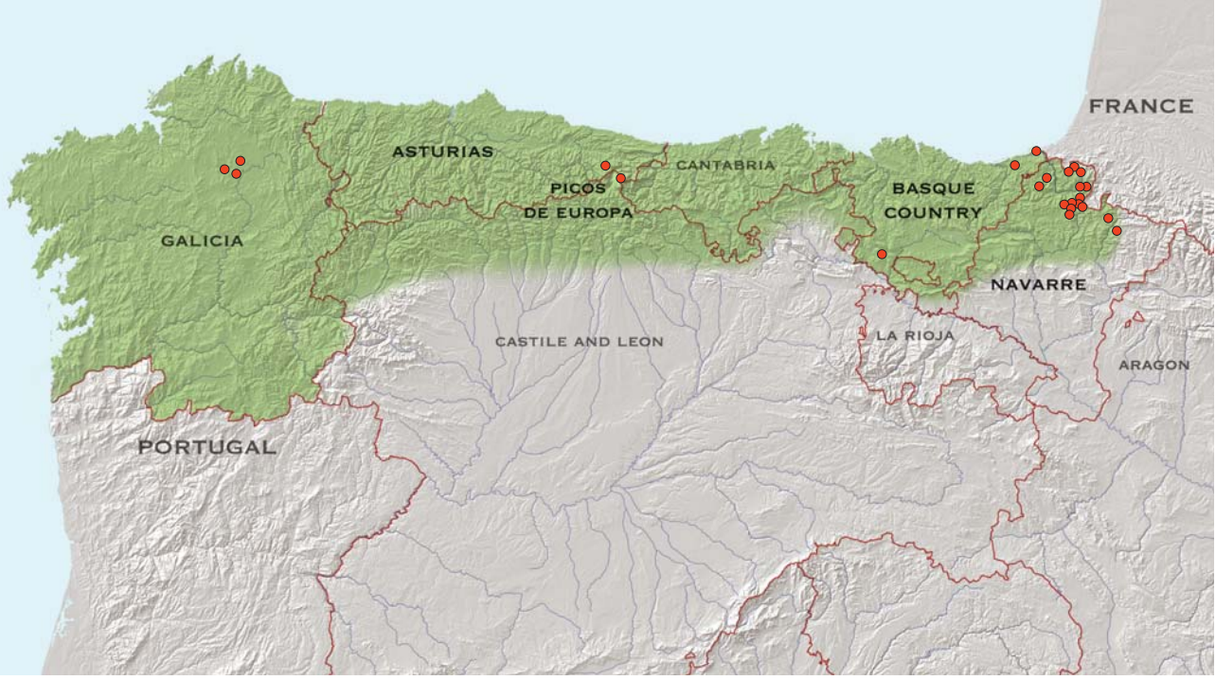
SUMMARY

The LIFE Tremedal project addressed the conservation and restoration of 25 wetlands on the Northern Iberian Peninsula and involved not only actions to increase our knowledge of all the sites and monitor them, but also specific restoration actions at 16 of their number.

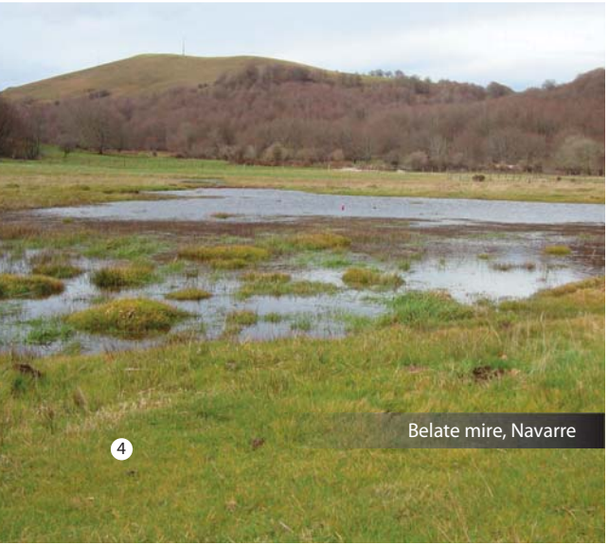
The development of the Life+ Tremedal project has contributed to improving scientific-technical information on mire and wet heath habitats in the territory of the Northern Iberian Peninsula. While the absence of habitat 4010 has been confirmed on the Iberian Peninsula, it has been possible to verify habitats 4020*, 7010*, 7120, 7130*, 7140, 7150, 7210*, 7220*, 7230 and 91D0* in the territories assigned to the Atlantic Region and habitats 7110*, 7140, 7150, 7210*, 7220*, 7230 and 91D0* in the Mediterranean Region. The information obtained as part of the Life+ Tremedal project is essential to the completion of the standard data forms for the Natura 2000 protected areas located in these territories and the reference list for the Atlantic and Mediterranean biogeographical regions.

Over the course of the project it has been seen that significant areas of habitats representative of wet heaths and mire ecosystems are not included in the Natura 2000 spaces. It has also been observed that the state of conservation of mire and wet heath habitats both within areas covered by the Natura 2000 network and areas which are not can hardly be considered favourable. The greatest loss of habitats of this kind is concentrated at the western end and in the centre of the Northern Iberian Peninsula, and is the result of building projects, the transformation of such sites into artificial pastures and reforestation with conifers and eucalyptus trees.

PROJECT ACTIONS AND SITES



General view of Alkurruntz, Navarre



Belate mire, Navarre

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LIFE Tremedal, a joint project for improved mire and wetland management.

From their different territories, the project partners (Galicia, Picos de Europa, the Basque Country and Navarre) initiated the following types of actions in 2012:

- Projects for the restoration of wetlands and their conservation over time.
- Work to enhance our knowledge of wetland habitats and the sites addressed in the project.
- Information and awareness-raising actions to publicise the environmental values of inland wetlands and the services they provide.

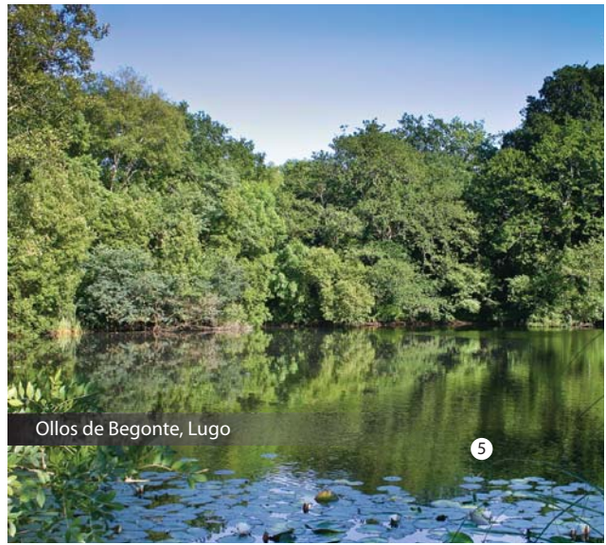
Most of the sites fall under the group of mires (peatlands, fens, bogs), or are transitional wetlands that hold plants and vegetation characteristic of mires:

- Vega de Liordes Mire / Posada de Valdeón, Leon (Special Area of Conservation, SAC Picos de Europa-Castile and Leon).
- Vega de Comeya Mire / Cangas de Onís, Asturias (SAC Picos de Europa-Asturias).
- Usabelartza Mire (SAC Leitzaran / Andoain, Gipuzkoa).
- Transitional wetland of Jaizkibel (SAC Jaizkibel /Pasaia, Hondarribia and Lezo, in Gipuzkoa).
- Navarre's mires and transitional wetlans (17 in total), mostly in the Valley of Baztan. The most noteworthy include the mires of Belate (SAC Belate), Arxuri (SAC Orabidea Brook and Arxuri Mire), Azaldegi (SAC Mount Alduide) and Baigura (Site of Community Importance, SCI Sierra of Artxuga, Zarikieta and Mountains of Areta), and transitional wetlands of Alkurruntz (SAC Orabidea Brook and Arxuri Mire), Okolin (SAC Belate) and Argintzu (SAC Mount Alduide).

The project sites also include three **wetlands associated with the river system** of the upper basin of the River Miño (SAC Parda-Ladra-Támoga, Lugo): the Island of San Roque, Wetland of Cospeito and Ollos de Begonte. The wetland of Ollos de Begonte is a wetland of karstic origin, but is closely associated with the river system.

Finally, Tremedal includes the Lake of Caicedo Yuso-Arreo, a **karstic wetland on gypsum** with an approximate surface area of 14 ha and a depth of over 20 m. Caicedo Yuso-Arreo is the only natural lake system in the Autonomous Community of the Basque Country and highly original in that it is one of the few known examples of a lake forming on salt chimneys found on the Iberian Peninsula.

Lake of Caicedo Yuso-Arreo, Alava



Ollos de Begonte, Lugo

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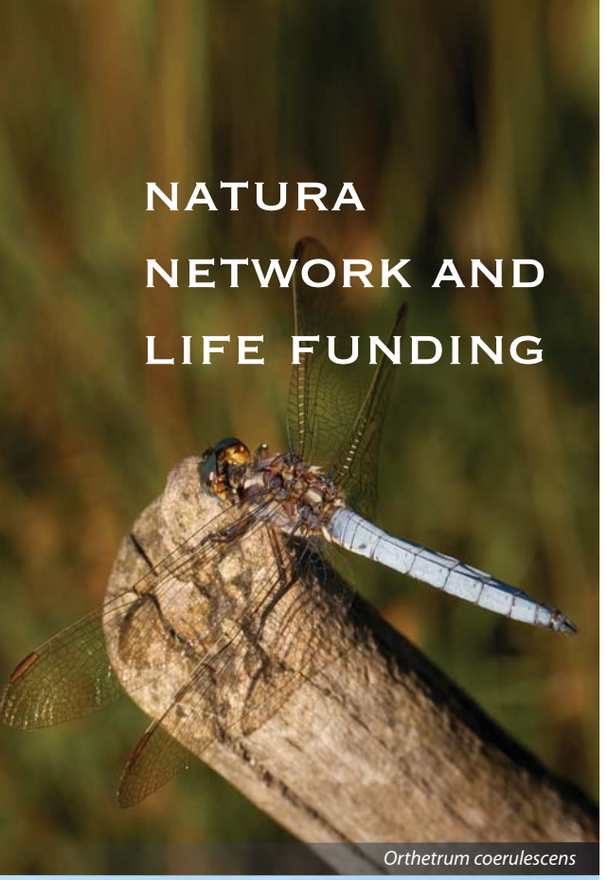
NATURA NETWORK AND LIFE FUNDING



Orthetrum coerulescens

Visit from the European Commission

The aim of the Tremedal project was to conserve and restore habitats and species considered to be of special interest within the European context (mires, humid grasslands, temporary pools, riverside woodland, etc.).

Many of these habitats and species are included in the annexes of the Habitats Directive (Directive 92/43/EEC), considered the most important legal instrument for biodiversity conservation at European scale.

The Habitats Directive also establishes the creation of the European network for biodiversity conservation: the Natura 2000 network. Most of the wetlands in Tremedal are included in the Natura network, so the actions implemented as part of the project mark significant development in the application of the measures included in the management plans for said areas.

In order to make progress in the application of the Directive, the European Union helps to fund nature conservation projects through the LIFE+ "Nature and Biodiversity" programme. The Tremedal project benefited from this programme, receiving LIFE co-funding accounting for 50% of the entire cost of the project (€2,824,867).

Some of the wetlands included in Tremedal came to form part of the Natura network while the project was under way. Such was the case of the Arxuri Mire (Baztan, Navarre), which is now included in the Special Area of Conservation (SAC) "Orabidea Brook and Arxuri Mire", and the Wetland of Jauregiaroztegi (Auritz-Burguete, Navarra), now included in the SAC "River system of the Rivers Irati, Urrobi and Erro". The processes to include these sites had begun before the LIFE project actually got under way, but, all the same, their inclusion represents a very positive accomplishment complementing the mire and transitional wetland area conservation actions implemented in Navarre over the last decade (including those of the LIFE Tremedal project).

Tremedal has also helped us to understand the need to take connectivity or the "vision of the whole" into account when it comes to approaching the conservation of habitats and species.

In Navarre, where the Tremedal project was seen as a tool for the development of the measures needed to conserve the region's most important mires and transitional wetland areas, it was necessary to include some sites which did not form part of Natura 2000, but which were also important, in the project. Given the rarity and high degree of isolation of the habitats and species involved, it is important to ensure the conservation of sites which may serve as reservoirs of species to combat the possible loss of populations.

The inclusion of these sites in Tremedal, together with other measures applied over recent years, will help to conserve these wetlands even though they do not form part of the Natura network.

World Wetlands Day in Begonte, Valedouro

Eriophorum angustifolium

A LOT OF THE TREMEDAL ACTIONS SEEK TO REVIVE SUITABLE WATER CONDITIONS FOR HABITATS AND SPECIES

First of all, it is necessary to understand how wetlands work, how they have been altered over history and how they can be recovered. It is also necessary to be aware of the specific requirements of the habitats and species that the actions aim to favour. The actions are often apparently simple to implement, but they require detailed previous analysis, thorough laying out on site, absolutely meticulous monitoring and, particularly, continuous evaluation of the results obtained.

Caicedo Yuso - Arreo is the only Tremedal site where land has been bought. A total of 12.7 ha were bought: 9.6 ha were being used for agricultural production; 1.3 ha formed part of the areas of the wetland with hygrophilous vegetation; 0.9 ha formed an area of

Dykes on the Belate mire, Navarre

Pool created on the Island of San Roque, Lugo

Caicedo Yuso-Arreo, Alava

Plugging on the Belate mire, Navarre

General view of the Usabelartza mire, Gipuzkoa

Eryngium viviparum

Ollos de Begonte

Claudium mariscus plantation in Ollos de Begonte

Drosera intermedia

Field work

woodland on the steepest slopes alongside the lake populated by holm oaks; the last three parcels, accounting for a total of 0.9 ha, had been left fallow and were covered with natural pastures. Buying this land meant it was possible to carry out the other actions included in the lake restoration project.

First of all, the contours were analysed to locate those areas which had been raised in order to stop or hinder water from the lake flooding the land. Ridges and earth build-ups were identified along the entire shore of the lake adjoining farm land.

Transversal test holes were also made across the land to define the original level of the lake, easily identifiable because the soil was dark as a result of the organic matter deposited. This outline guided the depth of excavation required to restore these areas.

A total floodable area of some 3,700 m^2 has been recovered, where it is hoped that the priority saw-sedge (*Cladium mariscus*) habitat will recover.

The **Lake of Cospeito** and the **Island of San Roque** in the province of Lugo provide further examples. The most noteworthy habitat at these sites was the "temporary pool" habitat, considered of interest at European level and also home in this area to one of the few priority plant species in the Habitats Directive: *Eryngium viviparum*. The action consisted of digging shallow pools in order to favour the waterlogging of certain areas in the summer.

In addition to the topographic correction work performed, the populations of *Eryngium viviparum* were also reinforced by planting out seedlings produced in nursery conditions from seeds collected in the area.

The actions implemented at the Lake of Cospeito to improve habitats have benefited other aquatic species. Not only populations of *Eryngium viviparum* (a priority species in Europe), but also populations of two other endangered plant species have taken hold: *Luronium natans* and *Pilularia globulifera*, both of which are aquatic plants listed in Catalogues of Endangered Species, the former in the Spanish catalogue and the latter in the Galician catalogue.

Work was also performed at **Ollos de Begonte**, another wetland in Lugo, to favour the habitat of saw-sedge (*Cladium mariscus*) formations, considered a priority habitat at European level. The conditions created by the diversion of water to supply an old washing place were corrected in order to keep the area waterlogged for a longer period of time.

The hydrological correction work carried out at the all-important **Usabelartza** Mire, the only mire in Gipuzkoa and one of the finest exponents of a habitat of this kind in the Basque Country followed the same lines. In this case, the actions aimed to halt the draining effect of a track which crossed one side of the mire. Usabelartza has a peat deposit which is more than one and a half metres deep in some areas.

Wooden dykes were installed in **Belate** to correct the impact of existing drainage systems and restore the hydrological functioning of the mire. The dykes were installed at points defined on the basis of a detailed survey carried out beforehand.

GRAZING ON WETLANDS AND PARTICULARLY MIRES, AN ETERNAL DEBATE UNDER THE SPOTLIGHT IN TREMEDAL

An excessive intensity of livestock farming had been noted in some areas of the project sites and this was affecting the development of the mire habitats. One example was the Vega de Comeya site in the Asturian sector of Picos de Europa, a very convenient spot to keep livestock and, consequently, an area in which a lot of cattle and horses concentrate throughout the grazing season. The project, therefore, excluded livestock and wild herbivores from three fenced-off parcels (enclosures with surface areas of 1.319, 757 and 740 m^2) in order to analyse the development of plant cover, soil and microtopography during the project and determine future management measures with which to attain a certain degree of equilibrium between traditional livestock farming and better conservation of the mires.

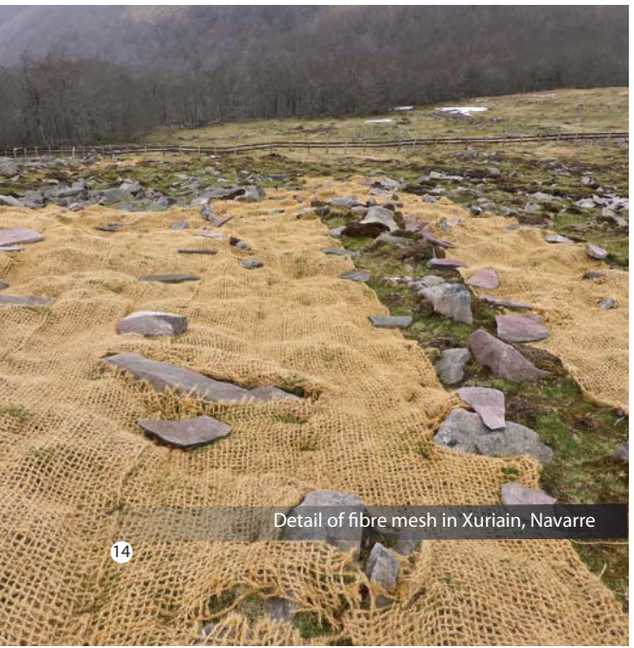
Likewise at the **Vega de Liordes** Mire in the Leon sector of Picos de Europa, two parcels were selected to have livestock excluded from them. One with a

Fence, Vega de Comeya

Vega de Comeya, in the Asturian sector of the Picos de Europa National Park


Detail of the enclosure at Vega de Liordes


Livestock-free and plantation parcels in Belate, Navarre


Detail of fibre mesh in Xuriain, Navarre

perimeter measuring 140 m in the part of the mire with Salix hastata subsp. picoeuropeana and the other, with a perimeter of 90.29 m, in the area with *Juncus balticus* subsp. *cantabricus*. In this case, the difficulty lay in the inaccessible nature of the site, which meant that it was necessary to transport the material by helicopter.

In Belate, the combined effect of installing dykes, which began in 2008 and continued through the Tremedal project period (2012-2015), regulating the grazing period and livestock densities, and bringing an end to fertilising and liming has led to a notable improvement in the vegetation on the mire.

The fencing erected in Xuriain has led to a significant increase in vegetation cover and height within the enclosure and a rise in the blooming and fruition of the species present. The laying of natural-fibre mesh in more eroded areas has also prompted a quick response in the vegetation, with significant colonisation by a range of meadow and heath species. The fibre mesh curbs the erosive effect of the wind and rain, and also helps to maintain moisture.

The regulation of livestock was accompanied in Belate and Xuriain with a successful pilot experience involving the plantation and transplantation of typical mire species, allowing species characteristic of mire habitats, such as *Narthecium ossifragum, Eriophorum angustifolium, Carex echinata* and *sphagnums*, to thrive.

Along the same lines, two fences with perimeters measuring 100 and 110m were erected on the Arxuri mire (Baztan) to analyse the effect of livestock on the development of habitats in the different parts of the mire. There exist areas of which the livestock, particularly cattle, is particularly fond and so it is necessary to discover the effect these animals have on the development of the habitats in order to apply future management measures.


Vega de Liordes mire in the Leon sector of Picos de Europa

The Arxuri mire is one of the largest mires in Navarre and is the site of one of the province's largest peat deposits. It is also one of the community's most important mires due to the number of protected and endangered species to which it is home. One of the enclosures was installed in an area where the presence of the orchid of European interest *Spiranthes aestivalis* had previously been registered in an attempt to see if the absence of the orchid over recent years could be put down to livestock.


Detail of the fence at the Arxuri mire, Navarre


Arxuri mire, Navarre

Coastline characteristic of Jaizkibel, Gipuzkoa

The contrary to what has been described so far was occurring at the transitional wetlands of **Jaizkibel** (Gipuzkoa). The control of livestock traffic by erecting fences in previous years as a pilot experience had led to a reasonable level of recovery of the sites in terms of soil and water, but the results concerning plant communities were disparate. While each site showed its peculiarities, it was observed that, in general, the land was going to brush in the absence of livestock and species which were not characteristic of the habitats which it was hoped would be favoured were appearing. To make matters worse, heliophilous species of interest, such as the insectivores ***Pinguicula lusitanica*** and ***Drosera intermedia***, species of pioneer mire habitats and included in the Basque Country's Catalogue of Endangered Species, were vanishing. In this case, the actions aimed to adapt the fences in order to make livestock access possible.

The **Alkurruntz** site in Navarre, where the exclusion of livestock to protect a water supply had led to a significant impoverishment of the vegetation, was in a similar situation to Jaizkibel. Gates were installed at this site to provide controlled livestock access and to make such access compatible with the protection of the water supply.

General view of Alkurruntz, Navarre

Pinguicula grandiflora

COLLECTION, STORAGE AND CONSERVATION OF GERMPLASM

One of Tremedal's transversal actions was the collection, storage and conservation of germplasm, which involved collecting the seeds (or plant material) of peatland plants and plants from other wet environments, and storing, conserving, germinating and cultivating them in the Germplasm Bank at the Atlantic Botanical Garden in Gijon (BGV-JBA).

This off-site conservation action formed part of the JBA's Conservation Programme, developed within the frameworks of the Convention on Biological Diversity, the Global Strategy for Plant Conservation and the European Plant Conservation Strategy.

Off-site conservation is one of the chief tools for the conservation of plant diversity as it aims to store and safeguard species in order to prevent their disappearance.

Thanks to this action, germplasm belonging to 20 structural and endangered species from the habitats covered by the project will be conserved and plants will be available for the restoration work proposed and any back-up work that may be required in the medium-to-long term to ensure the conservation of these habitats and species.

The entire collection, storage and conservation process was carried out according to pre-established guidelines and in view of the phenological characteristics of the target species. The procedure covered everything from planning the dates of collection through to obtaining grown plants, including actual collection work at suitable sites, carefully cleaning and drying the seeds, refrigerating them in conditions of minimum humidity and performing germination tests.

As a final result of this work, the complete cultivation protocols have been obtained for the species under study.

Of the actions carried out within the project to boost populations, the work performed with *Eryngium viviparum*, listed as a "priority species" in Annex II of the Habitats Directive, is particularly worthy of note.

Details of the collection, treatment and germination testing work (Atlantic Botanical Garden)

LIST OF PLANT SPECIES COLLECTED

Carex davalliana

Seed

Carex echinata

Seed

Carex hostiana

Seed

Carex lepidocarpa

Seed

Eryngium viviparum

Seed

Drosera intermedia

Seed, resting buds

Drosera rotundifolia

Seed, resting buds

Equisetum variegatum

Rhizome

Eriophorum angustifolium

Seed

Potentilla fruticosa

Seed, cutting

Juncus balticus subsp. *cantabricus*

Rhizome

Narcissus pseudonarcissus subsp. *nobilis*

Seed

Narthecium ossifragum

Seed, rhizome

Parnassia palustris

Seed

Pedicularis mixta

Seed

Rhynchospora fusca

Seed, rootball

Salix hastata subsp. *picoeuropeana*

Cutting

Spiranthes aestivalis

Seed

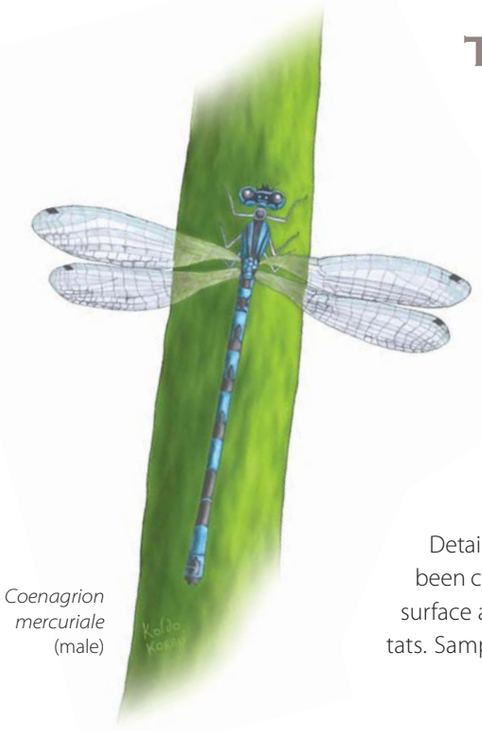
Swertia perennis

Seed

Triglochin palustris

Seed

DIAGNOSIS AND MONITORING STUDIES



Coenagrion mercuriale (male)

The Tremedal project partners and collaborators have made a significant effort to evaluate the success of the restoration actions on the state of conservation of the Habitats of Community Interest, Priority Habitats and species targeted, and establish the indicators on which the mid-to-long-term monitoring of the sites should be based. The impact of the project actions on the ecosystem services provided by the 25 wetlands included in the project has also been analysed.

Detailed cartographic studies of the habitats have been carried out in order to analyse changes in the surface areas and state of conservation of the habitats. Sampling using permanent quadrats has been performed to study the effects of some of the actions in depth. Permanent quadrats have been used, for example, to record data on different aspects of the plant cover inside and outside the livestock exclusion enclosures or in those areas most affected by the hydrological restoration actions taken (e.g. next to the dykes installed).

Other more specific studies have included those conducted at the Picos de Europa sites, where soil changes in the fenced-off areas were analysed by studying top layer samples. Laser scanner techniques were also used at Vega de Comeya to see if there existed any significant microtopographic differences as a result of trampling by livestock.

Regarding species, the work performed with priority species, particularly *Eryngium viviparum*, are worthy of note. Diagnosis and monitoring work has also been carried out on the odonata populations in Navarre's mires and trasitional wetlands, one of the key species analysed being *Coenagrion mercuriale*, an endangered species in Europe.

Ecosystem services have been studied using the TESSA methodology, which involves semi-quantitative evaluations of reference lists, first individually for each of the sites and then identifying common patterns. The chief conclusions highlight the fact that the habitat restoration work will favour the more vulnerable habitats and that a reduction of habitats used for grazing, agricultural and forestry purposes is expected. The most significant pressures, meanwhile, include livestock farming and human disturbance, although the greatest impacts come from invasive species, diffuse pollution, the use of land for production and a lack of social recognition. The cultural and recreational ecosystem services provided have been identified as the most relevant at present, even though they still need to be strengthened.

Monitoring the vegetation with sampling quadrats

Collecting soil samples at Vega de Liordes, Picos de Europa

Laser-scanner analysis of possible microtopographic variations caused by livestock trampling the mire

MIRE AND LACUSTRINE ENVIRONMENTS ARE THE CHIEF SOURCES OF INFORMATION FOR PALAEOENVIRONMENTAL STUDIES

Wetlands, particularly mires and lacustrine environments, store important palaeoenvironmental information. This is due to the significant concentrations of biological remains found in the organic deposits generated and their good state of conservation.

Biological remains from the surrounding area build up gradually in lacustrine environments and mires. This leads to the generation of sequences of sediments which record changes in the biological characteristics of the environment (flora and fauna) over long periods of time (5,000, 10,000 or 100,000 years).

By studying the sediments which have built up, therefore, it is possible to reconstruct the changes which have taken place in the configuration of the flora and fauna of the wetland and its surrounding area in relation with climate dynamics, and evaluate human impact on these processes.

The peculiar conditions of the sediments in wetlands, permanent humidity and a low concentration of oxygen, favour the concentration of certain biological remains (wood, fragments of leaves, fruits, pollen, spores, small edaphic invertebrates, the remains of dragonflies/damselflies and other arthropods, etc.).

The Tremedal project went to great lengths to compile all the existing information on palaeoenvironmental studies, which was, in many cases, not well known and only available in dribs and drabs. Specific studies were also conducted on some of Navarre's mires. The preliminary data collected points towards the existence of larger peat deposits than previously believed and may lead to new studies in the future.

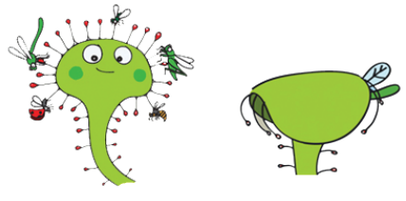
Details of the coring performed at different mires and of one of the samples extracted

TREMEDAL,

AN ENGAGING PROJECT SHARED WITH SOCIETY...

The TREMEDAL project has included a significant number of awareness-raising and dissemination actions, and all the partners have put a lot of effort into their implementation.

The website www.lifetremedal.eu, the promotional materials (T-shirts, story-books, bags, etc.), the information folder-leaflet and information panels have been the main elements of communication for the project as a whole from day one.



Numerous dissemination and awareness-raising events have also been held to engage a very wide-ranging public: from the local populations from each of the sites (councils, schools, associations, etc.) through to the scientific community and the general public.

Some of the events (school activities for different age groups, itinerant exhibition, publication of information leaflets, etc.) not initially planned in the project have managed to access a broader target audience, improving on the dissemination results originally expected.

The meetings held regularly with the different actors involved, necessary in order to implement the specific conservation actions have also helped publicise the project among the local populations and, above all, initiate the process through which to enhance appreciation of sites of this kind, which were totally unknown.

At the end of the project, we can state that most of the actors directly involved in biodiversity conservation management in each region (regional government officers with competence in the field, environmental and forestry protection bodies, forestry management officers, local authority representatives, local authority rangers, etc.) are aware of the project and have actively participated in its implementation.

The dissemination activities have been aimed at a wide range of audiences. The land custody experience, in which an agreement was reached to manage two of the Life Tremedal action sites in Galicia, the Island of San Roque and Ollos de Begonte, is particularly worthy of note.

Other local interest groups (local development agents, leisure companies and professionals, nature groups, cultural associations and the local population) have also been kept up to date (and will continue to be kept up to date in the AFTER-LIFE period) with the implementation and results of TREMEDAL.

The experiences developed in Tremedal related to volunteer programmes and land custody, both shared management tools and formulas, deserve special mention.

The coverage given to the project in the print and digital press (local, regional and national) has exceeded initial expectations and the "technical publications" produced have been well covered by the media.

Dissemination of the Life Tremedal project has not been restricted to the territories involved in the project; numerous workshops, meetings, visits and experience sharing events have also been held with other wetland conservation projects and experts, environmental associations, university students and teaching staff, etc.

Although TREMEDAL finished in 2015, all the material of interest generated (this Layman's report, the final Good Practices publication, the final versions of palaeoenvironmental studies, exhibitions, educational material, bulletins, etc.) will allow us to keep in touch with all the interested parties and continue to reach out to all kinds of audiences.

LIFE TREMEDAL

NATURA 2000

Partners

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Gestión Ambiental de Navarra, S.A.

Consorcio Interautonómico Parque Nacional de los Picos de Europa

Picos de Europa Parque Nacional

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Diputación Foral de Álava

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Universidad de Oviedo

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Jardín Botánico Atlántico

Gijón Ayuntamiento

Gobierno del Principado de Asturias

Junta de Castilla y León

Gipuzkoako Foru Aldundia
Diputación Foral de Gipuzkoa

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