This would allow treating 50% of water per year from l'Albufera nature park lake volume and improve habitat connectivity, reduce the pressure of the herbivorous birds on the vegetation and would help to reduce the effects of pollutions from agriculture.

Contacts

IIAMA
(Research Institute of Water and Environmental Engineering)
Polytechnic City of Innovation,
Building 8G, Access D, 5th Floor
Camino de Vera S/N
46022 Valencia, Spain
- phone: +34 96387 98 20
- email: info@iiama.upv.es

Fundación Global Nature (FGN)
Antonio Guillem Avivar
C/ Juan Ramón Jiménez 38 ptao 23
46026 Valencia, Spain
- antonioguillem@fundacionglobalnature.org
- website: www.fundacionglobalnature.org/

AGRÓ
(Acció Ecologista-Agró)
C/ Portal de Valldigna, 15
46003 Valencia, Spain
- email: lhorta@accioecologista-agro.org

SEO/BirdLife
(Sociedad Espanola de Ornitología/BirdLife)
C/Melquiades Biencinto, 34
28054 Madrid, Spain
- phone: +34 914 340 910
- email: seo@seo.org

ACUAMED
(Aguas de las Cuencas de la Mediterráneas)
C/ Albasanz, 11
28037 Madrid, Spain
- email: info@acuamed.es

Literature/Links/ Additional Information

LIFE Albufera (official site):
- *http://www.lifealbufera.org/index.php/en/*

LIFE Albufera (final report):
- *http://www.lifealbufera.org/index.php/es/final-report*

Humedales Artificiales en L'Albufera de Valencia:
- *http://www.lifealbufera.org/docs/pub/Folleto_LIFE_ALBUFERA_es.pdf*

- Layman's report. Integrated management of three constructed wetlands in compliance with Water Framework, Birds and Habitats Directives. LIFE12 ENV/ES/000685.

- Vicente, E. & R. Miracle (1992): The coastal lagoon Albufera de Valencia: An ecosystem under stress. Department of Microbiology and Ecology. Faculty of Biology, University of Valencia. Valencia, Spain

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GRÜNE LIGA e.V.
Water Policy Office
Greifswalder Str. 4
10405 Berlin
Michael Bender

phone: +49 (0)30 - 40 39 35 - 30
fax: +49 (0)30 - 204 44 68
email: wasser@grueneliga.de
internet: http://www.wrrl-info.de
donations account:
GLS Gemeinschaftsbank eG
IBAN: DE61 4306 0967 8025 6769 00
BIC: GENODEM1GLS

In cooperation with:

EEB European Environmental Bureau

EEB
European
Environmental
Bureau
Rue des Deux Eglises 14–16
B-1000 Brussels

phone: +32 2 - 289 10 90
email: eeb@eeb.org
internet: http://www.eeb.org
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GRÜNE LIGA Netzwerk Ökologischer Bewegungen

REDUCTION OF DIFFUSE NUTRIENT INPUTS

Wetland rehabilitation strategies: The benefits of green filters in Albufera

The eutrophication of the waters of the Albufera National park is a problem since the 60s, when the consistent population increase in the nearby urban area, the growth of intensive rice cultivations, and the industrial pressures led to the disappearance of the submersed macrophyte prairies. To contrast these pressures and improve the ecological status of the area, between 2007 and 2011, The Life Albufera project recreated three constructed wetlands, which act as water purification structures. These structures proved efficient in neutralizing the excessive nutrients in the water and for improvement of the water and habitat quality contributing simultaneously to the goals of the EU Water Framework Directive (WFD), the Nitrates Directive, and the Habitat and Bird Directive.

- **keywords: Green filters, Reduction of Phytoplankton, Sustainable Water Management, Lakes, Wetlands, Nutrient loading, Lagoons.**

Pressures/

The extensive use of spilling pollutants into the ecosystem caused by the agricultural sector is one of the main pressures for Albufera. Furthermore, the water balance is negatively affected by diverting water for the irrigation of the existing rice fields. The existing rice fields, settlements and infrastructures which are surrounding the park as well as recreational activities caused by tourism are decisive to affect the ecosystem balance.

Quality objectives

The construction of artificial wetlands helps to accomplish ecologic and economic objectives at the same time. It reduces the phytoplankton and allows instead the creation of zooplankton which is important to re-establish biodiversity.
The recreated wetlands offer a conservation spot for breeding birds and different local fishes and mammal species. This causes positive effects on the fishing sector as well as on tourism.

This vegetation has an important role: recreating natural ecosystems which are forming a Natural Reserves network of a great value for the avifauna. – photo: LIFE Albufera

MS/region/ locality/location/ river basin

L'Albufera natural park is located in eastern Spain about 12 km south of Valencia. Nowadays it extends over 21,000 hectares.
The Albufera Lagoon – with round about 2,800 hectares of surface area – and a large sandbank named Dehesa del Saler which separates the freshwater lagoon from the Mediterranean Sea as well as surrounding wetlands are forming this area with a great morphological variety.

Tancat de la Pipa. It has 40 ha and stands out due it's public use plan, which has allowed over 20.000 people to visit the wetland and to learn about its performance. photo: LIFE Albufera

That is why the territory was established in 1986 as a protected Ramsar Site and as Special Bird Protection Area (SPA) in 1994.

Nevertheless, today it is a man-made landscape which was formed during a long period of extensive rice cultivation since the second half of 18th century. This caused desalinization and progressive shrinkage of the lagoon over the years. The rice fields still cover 18,000 hectares surrounding the park and are watered though a system of floodgates connected to the park.

Motivation – What are the problems?

The Albufera ecosystem is under stress since the 60s. The urban, agricultural and industrial growth in Valencia led in an increasing degradation of water quality. The indiscriminate exploitation of the lagoon's waters thorough illegal hunting and fishing and discharge of nitrates and phosphates in the waters led to quick disappearance of underwater plants, most of the fish, molluscs, aquatic insects, small mammals and so also birds' population whose population was reduced drastically because they lost their sources of food. It ended with a consequent collapse of the lagoon ecosystem.

Tancat de l'Illat. This 16 ha site is located by the natural reserve of Estany de la Plana, in one of the canals that connect the lake with the sea. – photo: LIFE Albufera)

Relevance for Water Framework Directive (WFD)

The artificial wetlands contribute to the achievement of goals established by the Water Framework Directive. These projects are helping to enhance the status of aquatic ecosystems, as article 1of the WFD determines legally.
As stipulated per article 4 of the WFD the project in Albufera supports the achievement of a good ecological potential and good surface water chemical status of the lagoon connected to the Júcar river basin, by implementing measures aimed at reducing pollution from priority substances in accordance with Article 16 (1) and (8) of the WFD.

Objectives & measures adopted

Main objectives for sustainable conditions are to establish adequate management rules for artificial wetlands as well as a methodology to determine good status indicators for bird conservation.
The different measures implemented in the project aim to improve the water quality, to enhance biodiversity and to restore lost habitats for species. Therefore, the principal measure adopted is the reconstruction of artificial wetlands which act as green filters. This sustainable water purification system uses natural functions like vegetation, soil and organisms to remove a range of pollutants from the wastewater.
The wetland plots include three different sectors allowing the progressive water retention and purification. The constructed wetlands (CW's) offer a favorable spot for flora and fauna. There are about three different green filters implemented currently at Albufera: The Tancat de la Pipa, the Tancat de Milia and the Tancat de l'Illa.

Actors/ Procedure

The construction of the Tancats involved the collaboration of different partners following a participatory management scheme, which promoted greater interaction among the stakeholders and the participatory governance of the wetlands.
The importance of a close cooperation among public administration, NGO's and universities, was effective to demonstrate that it is the way to protect and enhance the environmental value of these nature areas, by means of land stewardship agreements with broad civil society participation.
Four associated beneficiaries, two major co-financers and other administrations participated. They are all listed here:

- *http://www.lifealbufera.org/index.php/en/* (participants)

LIFE Albufera (2013–2016) – One reason for realising the project: the existing biodiversity in these spaces is endangered by the negative impacts they are experiencing. – photo: LIFE Albufera

Results/ Assessments

The assessments of the results prove a positive outcome of the implemented measures on the biodiversity and water quality parameters. Based on the data gathering and monitoring activities conducted, over a period of two years the green filters processed 6.65 hm^3 of Albufera Lake water, contributing to the removal of: 11.2 tons of total nitrogen, 0.5 tons of total phosphorous, 198.2 kg of chlorophyll and 83.8 tons of suspended solids. They also contributed to the creation of zooplankton biomass, the reestablishment of submersed macrophyte prairies, the improvement of vegetable cover in the marsh vegetation habitat, the increase of flow-free area in areas 100 % covered by vegetation.
Other positive outcomes extend to the improvement of the conservation status of different species of breeding birds, the successful reintroduction of native species, and the removal of 587 kg of biomass of invasive exotic species. The wetland restoration measures have been already applied in two other Spanish natural parks and are considered applicable to other NATURA 2000 sites.

Costs and benefits

The constructed Tancats are estimated to provide additional environmental benefits in the long term, for instance by contributing to the fixation of atmospheric carbon. The future costs of infrastructure maintenance will be undertaken by the touristic and local traditional fishing sectors, which are predicted to increase their activities driven by the water quality improvement.
All in all, the final project cost of the monitoring project of LIFE ALBUFERA (2013–2016) has been 1,345,541.13 Euros of which 672,095.90 Euros were EU contributions.

Lessons learned

The project has fulfilled the purpose of improving quality of the water in Albufera and proved that the green filters are an efficient way to remove nutrients challenging the ecosystem balance.
Constructed wetlands, depending on its typology and vegetation cover, could reduce more than 75 % of phytoplankton and total suspended solids and more than 45 % of total nitrogen and phosphorus. The increase of zooplankton biomass and diversity is another important outcome.
The phytoplankton removal and the consequent increase of transparency in response facilitate the development of submerged macrophyte – a crucial factor to improve the biodiversity in wetlands as L'Albufera de Valencia. Based on this results it is recommended to extend the artificial wetlands to 200 ha, creating 10 new plots of about 20 ha each.

The basic principle of the constructed wetlands is the circulation of water along areas with vegetation.
photo: LIFE Albufera