Ponderful

PONDS FOR CLIMATE

URUGUAY

PONDSCAPES

European Commission

Pond Ecosystems for Resilient Future Landscapes in a Changing Climate

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No ID 869296

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WHAT IS A PONDSCAPE ?

DEFINITION

A pondscape is a network of ponds with spatial proximity ("connectedness") and the surrounding landscape matrix.

The boundaries of a pondscape may be determined by physical or ecological settings (a valley, a catchment, a set of ponds in a nature reserve) or even determined by societal or political criteria (urban ponds, provincial or national boundaries).

PRESSURE/THREATS ON PONDS AND PONDSCAPES

Around 90% of wetland areas in South America are estimated to have been lost since 1900[1], and the estimation for Uruguay is at least 35 to 50%[2]. Furthermore, natural and artificial ponds are largely neglected in water- and nature-related national and regional policies.

WHY IS IT IMPORTANT TO CARE FOR AND MANAGE PONDS AND PONDSCAPES ?

BIODIVERSITY ENHANCEMENT

Largely neglected and generally undervalued, ponds are remarkably important for biodiversity conservation. Pondscapes represent biodiversity hotspots.

DISASTER RISK REDUCTION

Ponds and pondscapes play a fundamental role in mitigating flooding and also constitute a water reserve to fight fires.

HUMAN HEALTH

Ponds and pondscapes provide a wide range of co-benefits for human societies such as support for human health and quality of life, spaces for physical activities, or social interaction, but also aesthetic experiences and educational and recreational activities.

CLIMATE CHANGE MITIGATION AND ADAPTATION

Given their abundance and their high productivity, ponds influence markedly the carbon cycle by acting as both carbon sinks and sources.

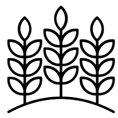
WATER MANAGEMENT

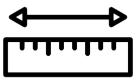
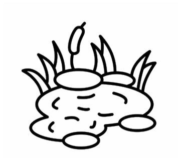
Pondscapes provide a water reserve that is particularly important in the context of water scarcity. Ponds can be particularly useful for watering animals and for irrigation.

CONTEXT

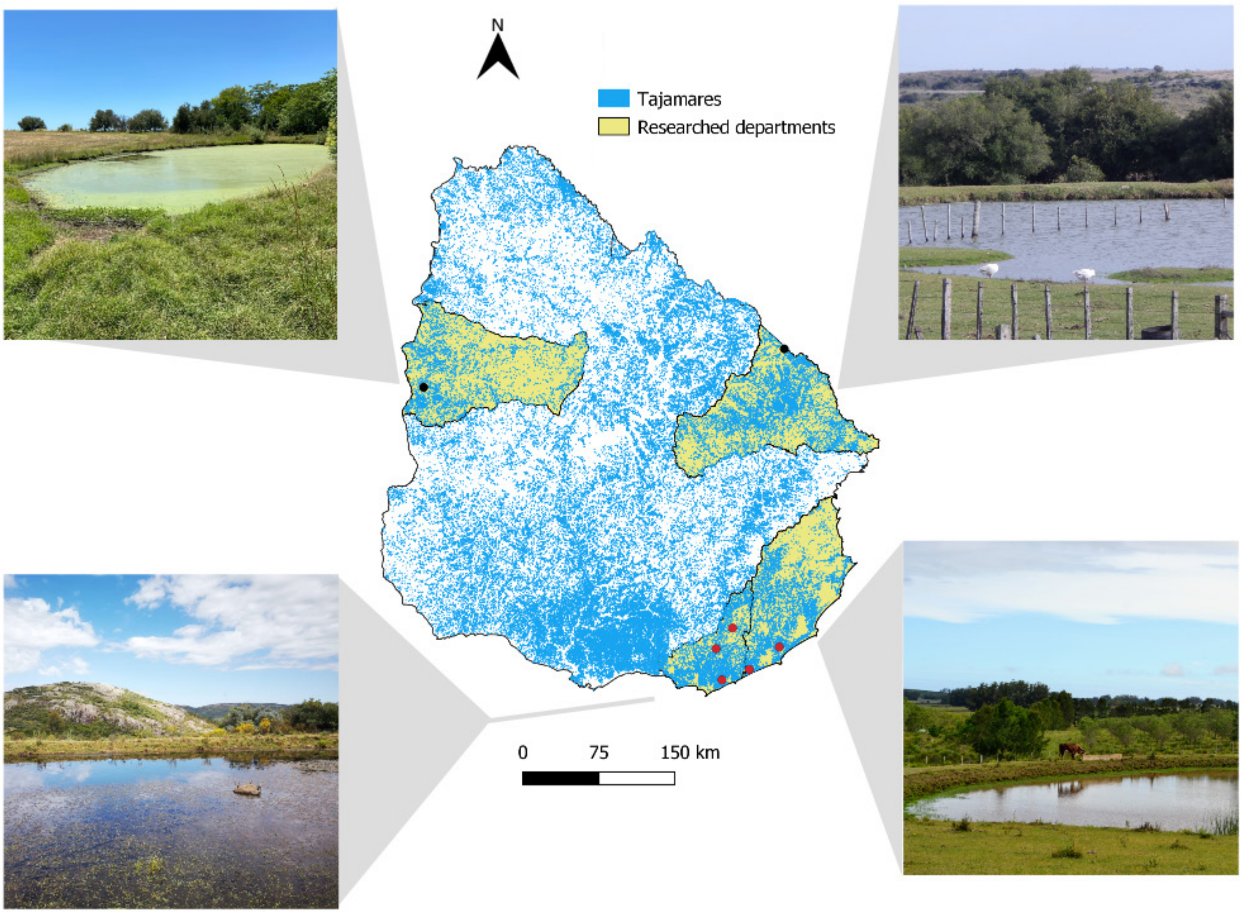
This leaflet highlights results from research projects that focused on artificial ponds in Uruguay. In Uruguay, rural artificial ponds (tajamares) are primarily constructed to support cattle production and secondarily for the irrigation of crops or other purposes. A small proportion is built to enhance the economic value of land due to their aesthetic appeal. Their numbers have been increasing dramatically since the early 2000s, coinciding with the intensification of agricultural production. As of 2022, natural grasslands cover 65% of the country's territory, having decreased by 20% from 1985 to 2022[3]. Simultaneously, natural ponds and wetlands are disappearing due to the advance of agriculture and urbanization advance. Tajamares occur in watersheds with different land use intensities (e.g., intensive cattle production on seeded pastures versus extensive cattle production on natural grasslands). They are almost exclusively owned and managed privately; therefore, public accessibility is very limited. Studies on their environmental impact and potential contributions to biodiversity are extremely scarce and incipient.

Bioclimatic zone : Temperate grasslands, humid subtropical climate.
Dominant land use : Cattle grazing (on natural grassland or pastures) and agriculture

Tajamares : Over 170'000 « tajamares de aquada » (meant to water cattle) by 2021 (according to the national spatial information infrastructure - IDE)
Density : The densest region is Canelones with over 4 tajamares per km^2, and the least dense region is Rio Negro with 0.3 tajamares per km^2
Surface area : The most frequent surface area is between 90 m^2 and 0.5 ha, but «tajamares de aguada» can reach up to 4 ha.
Water column : Usually from 0.5 to 3m. (Technical guidelines from the Ministry of Agriculture, Cattle and Fisheries (MGAP) recommend water columns higher than 2m.)



Map of Uruguay showing the different departments where artificial ponds were studied for this leaflet. In red are the pondscapes studied by the Ponderful team at CURE, 5 pondscapes containing 6 tajamares each. In black, locations where tajamares were studied by a team at CENUR Litoral Norte.

LOCAL POLICIES

Construction of tajamares de aguada has been promoted for decades by different administrations, either through technical assistance or loans to farmers at the national and municipal levels. Due to their small area, tajamares do not require environmental authorization for construction. In principle, all tajamares, regardless of size, should be registered and built according to specific technical guidelines to secure water volume. However, this is rarely done due to associated costs, and fines are almost never applied. Management is not monitored, leaving it up to the farmers to implement measures they deem appropriate, including in those ponds constructed inside Protected Areas.

- As of 2021, there are more than **170,000 tajamares de aguada** country-wide[4]**.**

170’000

- Only 0.25% of “tajamares de aguada” are registered, mainly because of the high costs of hiring the technical staff needed and official documents required [4,5].

0.25%

- 12.2% of Uruguay’s territory is classified as having maximum or high conservation priority, a lot of that area is condensed in the southeastern region[5].

12.2%

The last handbook for design and construction of “tajamares” is from 2012: this handbook produced by MGAP[6] has technical guidelines and focuses on production, with little consideration for environmental aspects.

REMAINING THREATS

1. The increase in eutrophication promotes biodiversity loss, deterioration of water quality, and impacts on productive and recreational uses. Additionally, it contributes to higher greenhouse gas emissions.

2. Toxic cyanobacterial blooms are common in high-intensity land use ponds, driven by nutrient inputs into the water (manure, fertilizers, and runoff from agrochemicals).

3. In high-intensity ponds, free-floating plants (water hyacinths, water lettuce, duckweeds, etc.) covering the water surface are also frequent. This prevents oxygen diffusion and leads to the death of many aquatic organisms.

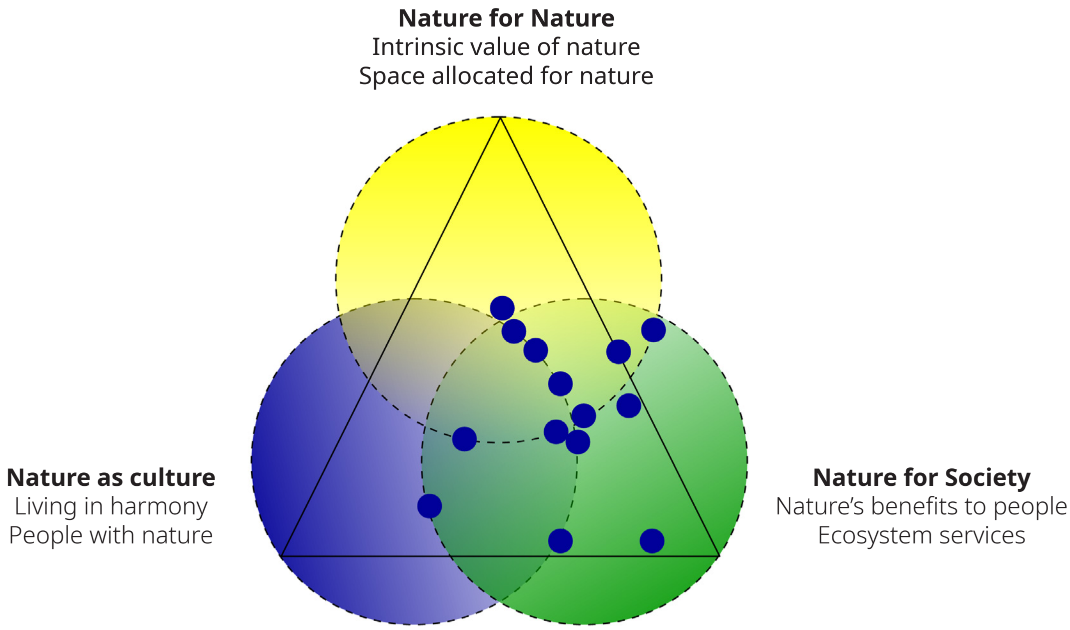
4. In different parts of the country, invasive exotic species originating from aquaculture activities have been found, such as the American bullfrog, common carp, and herbivorous carp. Although there are no wild records yet, there is a risk of the same happening with other cultivated species, such as Nile tilapia and Australian redclaw crayfish.

5. Other exotic species used in aquarism (like the African clawed frog) are also a threat to native biodiversity.

6. Some fish species, both exotic and native, have been intentionally introduced, ignoring the environmental damage caused. The absence of fish in some ponds is natural and promotes greater regional biodiversity.

7. Agrochemicals—pesticides, herbicides, and insecticides—are increasingly found in both water and aquatic biota. This leads to local biodiversity losses and abnormalities in some organisms.

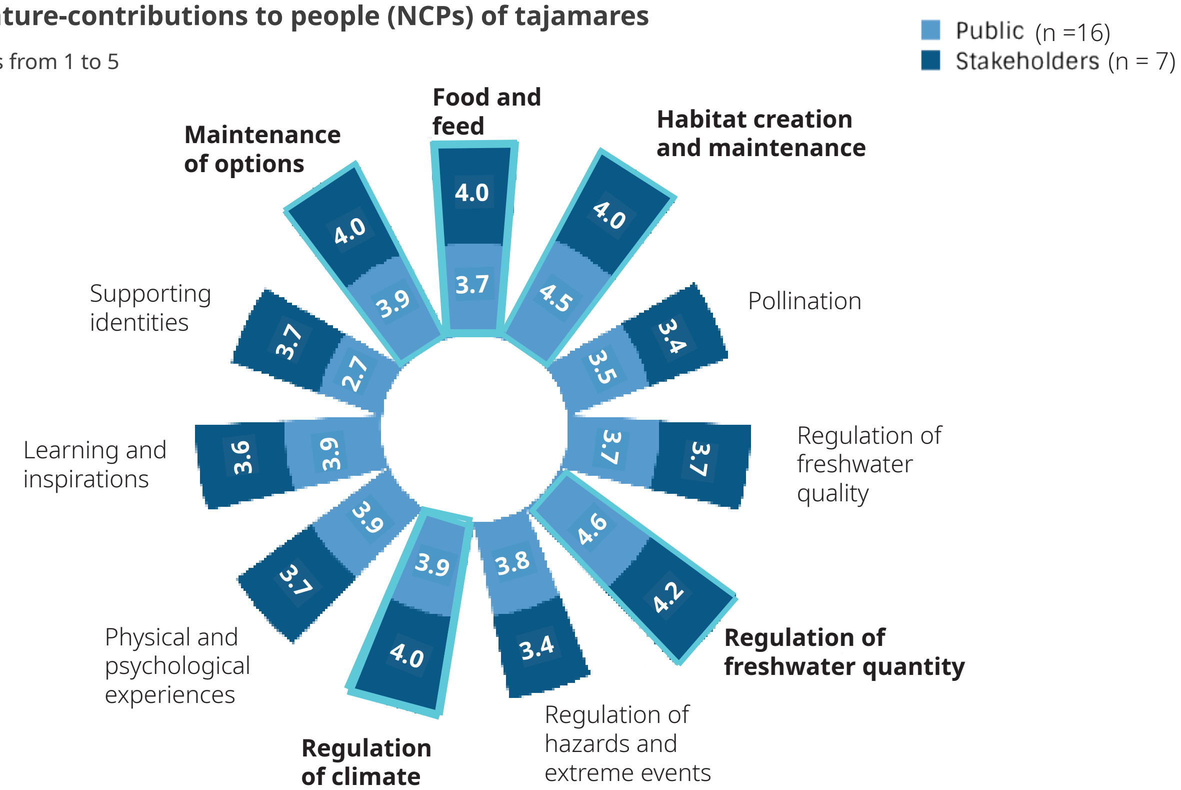
LOCAL COMMUNITY EXPECTATIONS



The Nature Futures Framework[7] proposed by IPBES shows three key value perspectives for ecosystems. Most stakeholders highlighted the role of Uruguayan tajamares as more valuable for society rather than for culture or for Nature itself (workshop held in December 2021).

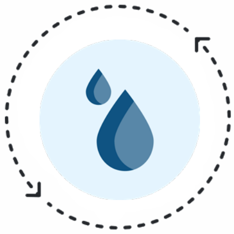
The 11 Nature-contributions to people (NCPs) of tajamares

Scale : scores from 1 to 5



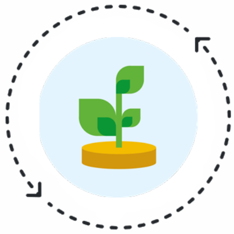
The expectations rely mainly on (i) Water quantity and quality, (ii) Habitat creation and maintenance and (iii) option maintenance and resilience besides the obvious food and feed. This survey has been conducted on two pondscapes : La Pedrera and Sierra de los Caracoles.

MAIN CHALLENGES FOR TAJAMARES



WATER MANAGEMENT

Management practices that enhance water quality and quantity, for instance creating a riparian buffer, fencing ponds to prevent direct cattle access, and removal of dense free-floating plants, are not always used and sanitary risks for cattle and native fauna are frequent.

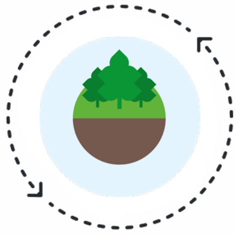


ECONOMIC OPPORTUNITIES

Relatively high costs and lack of environmental concern are the main reasons tajamares are not ideally designed or managed. These costs are related to hiring professionals, making upgrades to the existing ponds and monitoring water quality.

PARTICIPATORY PLANNING & GOVERNANCE

Stakeholders highlight a lack of technical support and monitoring programs. A notable concern of farmers is the interruptions in state-supported programs for building and managing tajamares, with no resources allocated for monitoring their quality.



BIODIVERISTY ENHANCEMENT

If eutrophic and poorly managed, rural ponds can be detrimental to native biodiversity and generate environmental problems, like cyanobacterial blooms or the promotion of invasive species. Tajamares in grassland areas tend to have better water quality than those in pastures. Healthier and more heterogeneous ponds support a higher biodiversity and are safer for cattle, native fauna, and people

NATURE BASED SOLUTIONS (NBS)

ARTIFICIAL PONDS AND PONDSCAPE MANAGEMENT

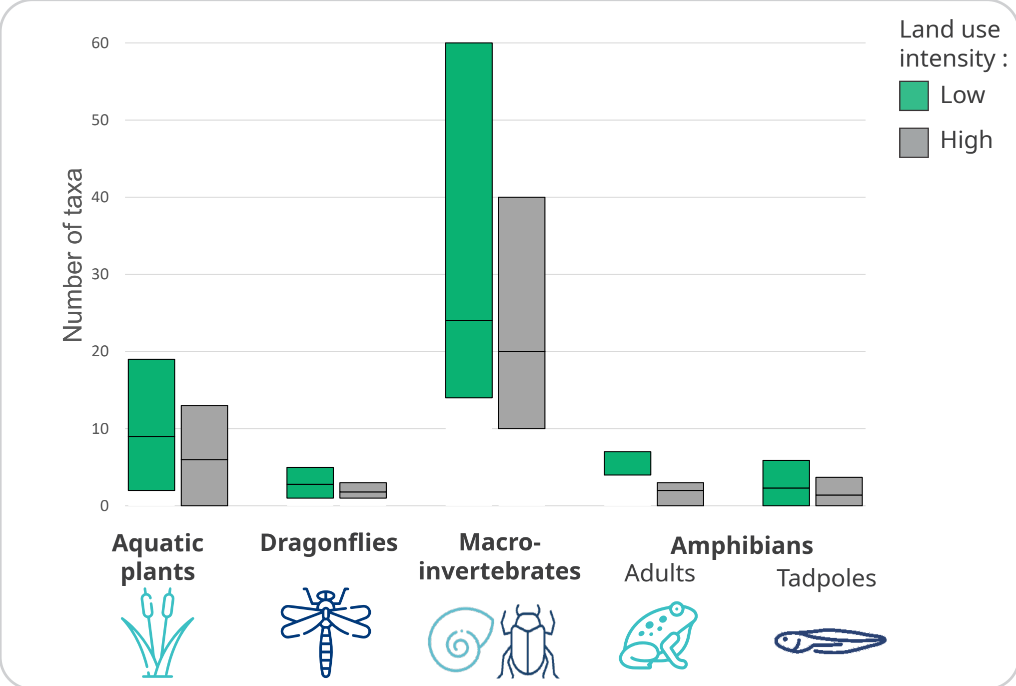
Rural pond creation rate changes depending on the regional land use, local water situation and funding efforts and support from goverment. Nature-based Solutions (NBS) are “actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously benefiting people and nature”[8]. Several NBS can be applied to face these challenges:

- Conservation of natural grasslands
- Reduction of the use of agrochemicals
- Fencing to prevent soil erosion and manure from livestock
- Implementing (or enlarging) the buffer area immediately surrounding the pond
- Management plans to control dense covers of free-floating plants
- Regular monitoring of physical, chemical and biological indicators

- Removal of introduced non-native fishes, amphibians, or plants
- Fencing and diverting water to external cattle drinking
- Restoration or creation of habitats by diverse native riparian vegetation
- Measures to provide connectivity for amphibian populations and other native fauna
- Landscape perspective for pond management, drainage, etc.

NATURE CONTRIBUTIONS TO PEOPLE AND MEASURED INDICATORS

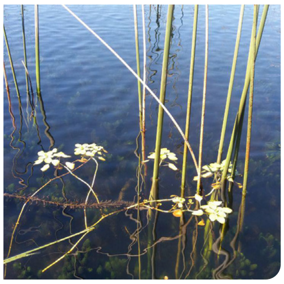
AQUATIC BIODIVERSITY IN WATERY TAJAMARES



EXAMPLES OF NATIVE SPECIES :


Scinax squalirostris


Nymphoides humboldtiana


Potamogeton natans


Leptodactylus luctator

REGULATION OF FRESHWATER QUANTITY, LOCATION AND TIMING

100%

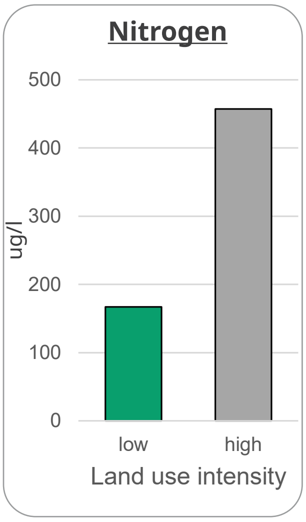
100% of tajamares are artificial, created with the purpose of holding freshwater. They are frequently created using tractor scrapers or excavators in low-lying areas, or by damming running waters like streams or ditches to

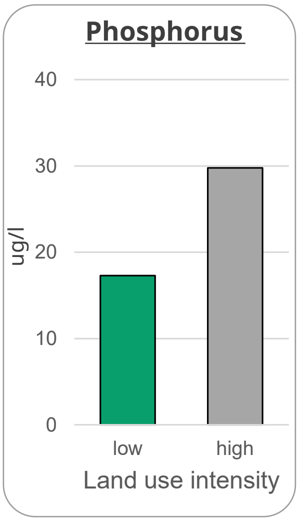
NATURE CONTRIBUTIONS TO PEOPLE AND MEASURED INDICATORS

FOOD AND FEED

All “tajamares de aguada” are created to give water to cattle, being livestock one of the main economic activities in the country.

100%





REGULATION OF FRESHWATER QUALITY

Studies carried out in different parts of the country found that most tajamares are eutrophic, meaning they have very high levels of nutrients and poor water quality. In some areas they are even hypereutrophic[9]. This could place a sanitary risk to cattle and humans, and might result in biodiversity loss, and a risk to other freshwater sources.

14 chemical compounds were found in the country’s northern tajamares: 6 herbicides, 4 fungicides and 4 insecticides, some with levels above chronic toxicity. Compounds were found in both water and biota (macroinvertebrates and predatory fish).

HABITAT CREATION AND MAINTENANCE

If well managed, tajamares could be a habitat for threatened species.
Having a buffer of native plants at the margins of tajamares reduces their nutrient load, reduces soil erosion and creates habitat heterogeneity, generating an overall healthier system that can sustain higher biodiversity and better water quality.

REGULATION OF HAZARDS AND EXTREME EVENTS

Different public policies and practices promote the creation of tajamares as a measure of adaptation to climate change and climatic variability. Many farmers dredge tajamares during droughts, often without technical assistance.

COSTS AND BENEFITS ANALYSIS

OVERALL COSTS ASSESSMENT

$ $ $

BENEFITS ASSESSMENT

LOW INTENSITY LAND USE

Water quality improvement

Water source

Flood management

Habitat provision

Erosion control

Recreation and well-being

Food and materials

Conservation value

HIGH INTENSITY LAND USE

Water quality improvement

Water source

Flood management

Habitat provision

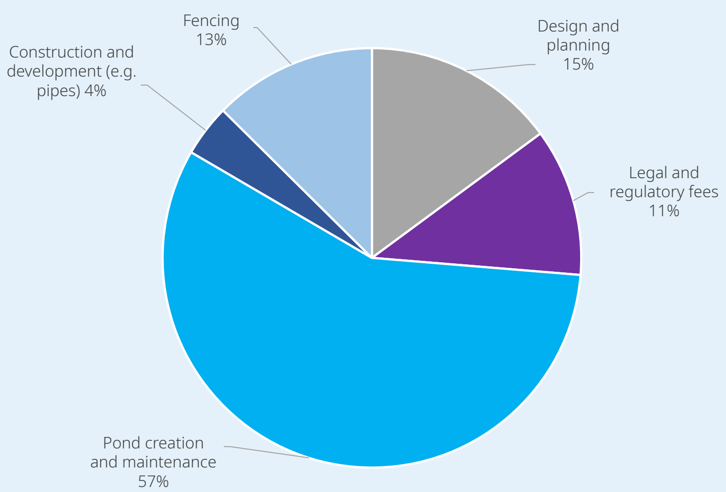
Erosion control

Recreation and well-being

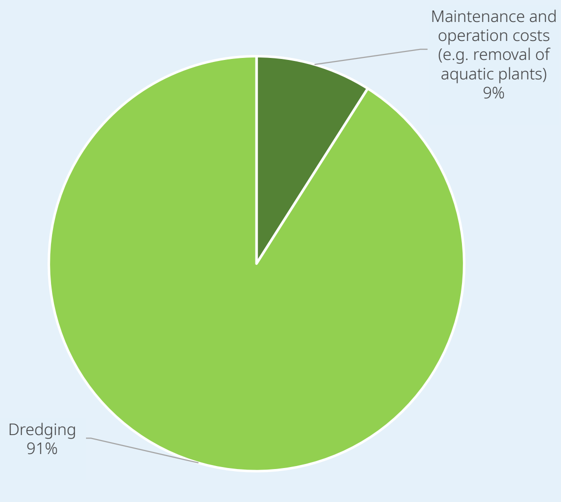
Food and materials

Conservation value

SHARE OF COSTS FOR NBS ACTION



Relative cost of NbS creation measures



Relative cost of ongoing NbS management measures

SUITABLE FINANCE INSTRUMENTS TO REDUCE THE GAP

- [ ] 1. Sale of market goods and services
- [x] 2. Public/private partnership
- [ ] 3. Tax concessions
- [ ] 4. (Green) loans
- [ ] 5. Commercial investing
- [x] 6. Agricultural subsidies

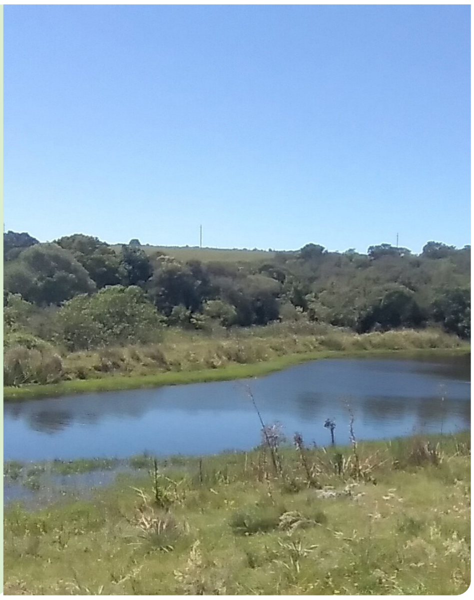
☑ = YES ☐ = MAYBE

SUCCESS STORY AND TRANSFERABILITY

REGENERATIVE LIVESTOCK FARMING IN LA PEDRERA

Family farmers have constructed tajamares since 2010 to mitigate the effects of climate variability and support cattle production while contributing to biodiversity. They have practiced regenerative livestock farming since 2019. They rotate the cattle to a different area at regular intervals, limiting their stay to allow for land regeneration and vegetation regrowth, and water quality recovery. The complete rotation takes around 100 days. Their goal is to mimic the natural movement of herbivore herds.

Some tajamares have no direct cattle access, while others have limited access due to electric fencing. They have observed big improvements, especially in diversity and abundance of macrophytes, waterfowl, and overall biodiversity.



LOW INTENSITY LAND USES PROMOTE HEALTHIER PONDS.

Ponds and pondscapes inserted in low land use intensity and with greater proportion of natural grasslands in their basins show higher water quality, lower risk of cyanobacterial blooms, higher aquatic biodiversity, and lower GHG emissions. At the local and landscape levels, low land use intensity areas can mitigate the negative effects of agricultural intensification on water quality and biodiversity. Local management of the ponds is also important, as a significant presence of riparian vegetation around tajamares reduces erosion and nutrient inputs, and at the same time contributes with new habitats for native fauna and flora.

Based on the scientific literature, managing ponds at different spatial and temporal scales can further promote biodiversity within the same productive unit and at the landscape level[10] (e.g., dredging some and not all ponds at the same time, and dredging only part of the individual ponds to avoid impact on the biota).

CONCLUSION

Tajamares could exert a positive or negative impact on the environment, depending on their design, construction, and management. Properly managed ponds have the potential to alleviate local biodiversity and wetland losses. Manuals for the design, construction and management of tajamares should incorporate environmental challenges and guidelines. Monitoring and management practices to safeguard water quality and biodiversity are increasingly needed in light of the growing challenges posed by eutrophication, climate variability and climate change.

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2024

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