

WATER

Resources and natural environment



© Céline Dubreuil

Mediterranean wetlands: an economic valuation of their services to climate change adaptation and regulation

Half of all Mediterranean wetlands disappeared over the 20th century. They have declined to now only 18 million hectares (Mediterranean Wetlands Observatory, 2012). However, wetlands are home to some of the richest yet most threatened ecosystems on the planet. Wetlands provide many ecosystem services that promote human well-being (Pearce, et al., 1994), including regulating services (e.g. water purification, flood control), provisioning services (e.g. fishing, irrigation, raw materials) or cultural services (e.g. recreational or educational services).

The role of wetlands in climate regulation still too little known

Many studies have demonstrated the impact of climate change on ecosystems including wetlands. Mediterranean wetlands are particularly impacted as, according to IPCC reports, the Mediterranean is one of the regions most vulnerable to climate change, with significant consequences on water resources, particularly in arid and semi-arid zones. On the contrary, the role of wetlands as an adaptation or mitigation tool is too little studied and underestimated in countries outside the European Union. Wetlands do mitigate the effects of climate change, helping to reduce the level of greenhouse gas emissions (e.g. carbon sequestration by peatlands, salt marshes, etc.) or do provide adaptation services by protecting us from flooding, drought and coastal

storms (e.g. lagoons, mangrove swamps, floodplains, etc.). Intact floodplains help to limit the risk of flooding by storing water and then releasing it gradually into streams and rivers.

First ever economic valuation of regulating services provided by Mediterranean wetlands

In order to improve knowledge and promote taking into account the climate mitigation role of Mediterranean wetlands in policies towards adaptation and natural disaster prevention, Plan Bleu launched in 2013, in partnership with Tour du Valat, the Med-ESCWET project. This project is co-funded by the MAVA Foundation and the Prince Albert II of Monaco Foundation. It **aims at estimating the economic value of ecosystem services related to climate change adaptation and mitigation** provided

by Mediterranean wetlands. It also seeks to promote the use and restoration of 'natural infrastructure' as climate change adaptation measures, rather than the artificial infrastructures widely emphasised so far.

Four Mediterranean wetland areas, each associated with a single ecosystem service, were selected for the study:

- the **coastal protection service provided by the Étang de Vic coastal lagoon** (Hérault, France);
- the **flood control service provided by the Lonjsko polje floodplain** (Croatia);
- the **carbon sequestration service provided by the Yeniçağa peatlands** (Turkey);
- the **carbon sequestration service provided by the Lake Burullus** (Egypt).

For each site, the analysis involves a biophysical assessment phase and an economic assessment phase of the ecosystem service.

The Med-ESCWET project is at the interface of academic fields:

- economic valuation of ecosystem services is a multidisciplinary exercise (involving both biophysical and economic methods);
- commonly used economic valuation methods aims at a "total economic value", covering all ecosystem services in the studied area. The Med-ESCWET project, in contrast, reviews the value of a single ecosystem service in each selected area.

Monetary values reflecting the specificities of the studied sites but also the methodology used

Such economic valuations must be seen in context and with caution. They partly reflect the specificities of the studied sites but also the methodology used. Indeed, the economic estimate depends upon the actual protection status and management of the site. The value also depends on the selected economic method and the robustness of the prior biophysical assessment.

In the Med-ESCWET project, the relatively low economic value attributed to coastal protection service for the Étang de Vic (which is managed in an exemplary manner by the Conservatoire du Littoral) is the consequence of the low level of anthropisation prevalent at this site leading to a decrease in the estimate of coastal degradation impacts on human populations.

But, at the same time, the low economic estimate of coastal protection also shows how effective this buffer area is in providing storm protection.

Furthermore, a very high value is attributed to the flood protection service provided by the Lonjsko polje floodplain in Croatia, which currently requires human management of the retention potential in the natural areas. The site absorbs excess water when the Sava and its tributaries are in flood, protecting the downstream populations from potentially large-scale damage (even when the ecosystem service is provided, the estimated damage is significant).

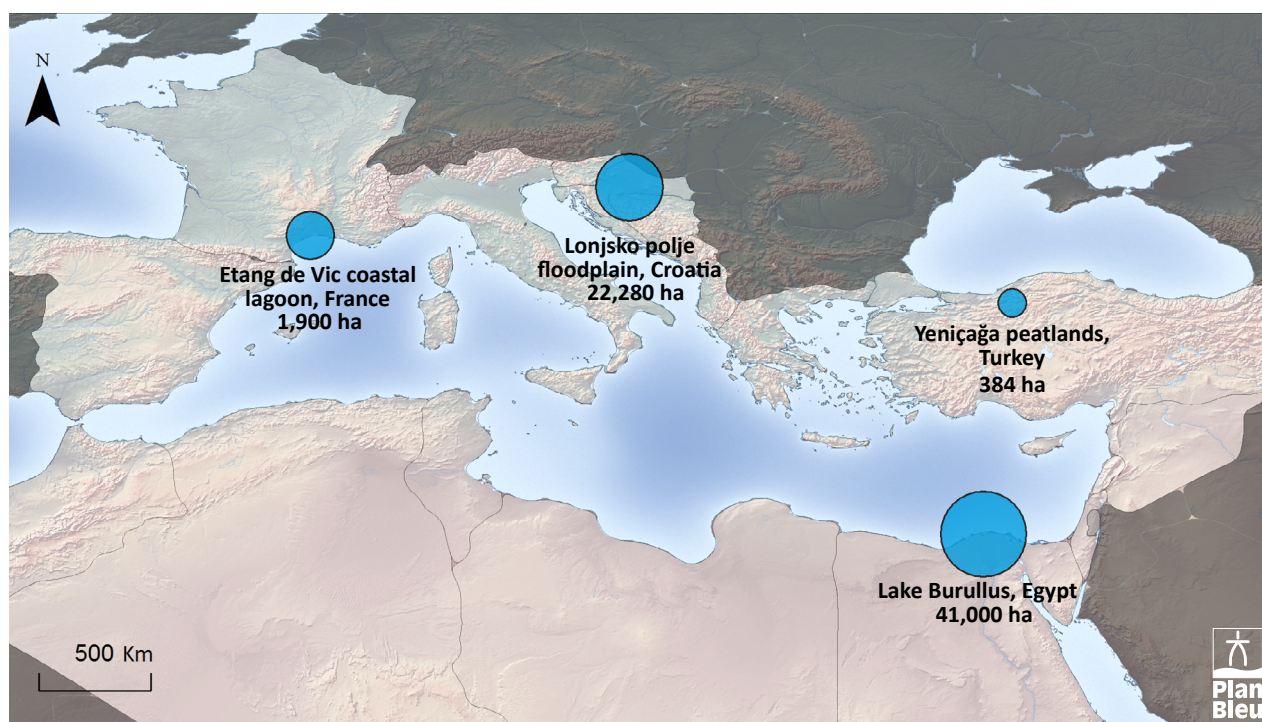


Figure 1. Location and scale of the pilot sites

Table 1: Monetary values of provided services

Site & Service studied	Considered area (ha)	Economical method	Total value (€ or € per year)	Unit value (€/ha or € per ha per year)
Étang de Vic, France – Coastal protection	1,900	Avoided damages costs	€2,273,680	€1,197 ha ⁻¹
Lonjsko polje floodplain, Croatia – Flood control	22,280 (artificial retention basins)	Replacement costs	€1,516,272,085	€68,055 ha ⁻¹
Burullus lake, Egypt – Carbon sequestration	41,000	Social cost of carbon	45,755,600 €.yr ⁻¹	€1,116 ha ⁻¹ .yr ⁻¹
Yeniçağa peatlands, Turkey – Carbon sequestration	383.4	Marginal abatement cost of carbon	664,967 €.yr ⁻¹	€1,734 ha ⁻¹ .yr ⁻¹

It should be noted that the replacement cost method used for this valuation is known to identify higher costs than other methods such as the cost avoided method.

For the Egyptian and Turkish sites, the carbon sequestration service is evaluated by use of distinct methods. They lead to different prices of CO₂ tonne. The methods used here, however, conclude to similar order of magnitude in the values obtained for Yeniçağa peatland, whose exploitation is strictly limited, and for the overexploited Burullus Lake. Carbon sequestration services can be increased by the presence of human activities¹, not reflecting conservation efforts.

Despite these limitations, this study remains pertinent, useful and pedagogical. Beyond its quantitative results, it brings forward considerable and unprecedented insights.

Economic valuation: a difficult exercise bringing an increased awareness of the economic importance of protecting wetlands

The biophysical assessment and economic valuation of ecosystem services in relation to climate change is exploratory and rigorous. Some of the methodological choices made require caution in interpreting and comparing results:

- **An interdisciplinary approach, service by service:** the study analysed different ecosystem services, requiring expertise from different scientific disciplines. Only one service was assessed for each site;
- **A regional, multi-site approach:** the Med-ESCWET project chose to study four sites in the North, East and South of the Mediterranean; the sites were different in nature, in hydrogeological and hydrobiological functions, in size, in level of development and anthropisation. The study findings are not suitable for comparison;

- **An assessment approach using partial data:** the studies performed for the Med-ESCWET project are based on data acquired in previous research programmes with different objectives (e.g. Evrendilek et al., 2011). Data were supplemented by estimates, updates and sometimes data transfers from other sites.

These choices nonetheless highlighted the significant role of these areas in combating climate change, both in terms of adaptation and mitigation. While other studies often emphasize the vulnerability of these wetlands to climate change, the present economic study reinforces arguments in favour of their conservation.

In the Med-ESCWET project, each of the four study sites was valued with a focus on a single ecosystem service, therefore not addressing the evaluation of the total economic value (TEV) of the site or the complex interactions between different services.

Local managers, key stakeholders in tackling climate change

Conventional approaches encourage efforts to combat climate change in many ways (e.g. mobilising states, enterprises, cities, NGOs, scientists) but do not stress responsibilities of local managers. The Med-ESCWET project demonstrates the key role of local managers in mitigation and adaptation to climate change. The role of 'green infrastructure' in climate change adaptation is illustrated in the project case studies, by the variety of situations and wetlands presented. The study emphasises the importance of better regulating human usage of these fragile environments in order i) to limit greenhouse gas emissions, and ii) to protect coastal systems that provide a storm barrier, while promoting sediment flow. It also demonstrates the relevance of conserving large, well-connected floodplains in a coherent manner across borders, in order to ensure flood protection for local populations.

The economic valuation of climate change adaptation and mitigation services considered here represents the start of an approach that has not been widely developed in the Mediterranean Region, and this could feed into broader valuation studies. Although the hazards of improper generalisation should be borne in mind, as

¹ For instance, the carbon sequestration service in Lake Burullus is mechanically stimulated by the inflow of organic carbon in wastewater flowing into the lake.

mentioned above, estimates of the total economic value of wetlands could help to ensure a better understanding of environmental management issues, via cost-benefit studies for site managers and policymakers, for instance. More broadly, projects linking science and public management rarely involve economists in the Mediterranean region.

Finally, the results of this study could also help the development of impact indicators focused on ecosystem services provided by Mediterranean wetlands, as initiated by *Tour du Valat*. Developing such indicators (e.g. role of wetlands in water supply, drought and flood mitigation, carbon sequestration or water purification) would help to provide an overall inventory of the environmental protection roles played by Mediterranean wetlands.

Bibliography

Eid, E.M. and Kamal H. Shaltout (2013). Evaluation of carbon sequestration potentiality of Lake Burullus, Egypt to mitigate climate change. *Egyptian Journal of Aquatic Research* 39. 2013.

Evrendilek, F., Berberoglu, S., Karakaya, N., Cilek, A., Aslan, G. and Gungor, K. (2011). Historical spatiotemporal analysis of land-use/land-cover changes and carbon budget in a temperate peatland (Turkey) using remotely sensed data. *Applied Geography* 31: 1166-1172.

Mediterranean Wetlands Observatory (2012). *Mediterranean Wetlands Outlook*. 2012.

Pearce, F. and Crivelli, A.J. (1994). *Characteristics of Mediterranean Wetlands*. Arles: Medwet, 1994.

Plan Bleu (2016). *Economic valuation of services provided by Mediterranean wetlands in terms of climate regulation*. Plan Bleu, Valbonne.



© Mocvarni Krajobraz, Lonjsko polje Nature Park

Lonjsko Polje floodplain, Croatia



© bionicpt

Lake Burullus, Egypt



© SIEL

Etang de Vic, France



© Céline Dubreuil

Lake Yenicağa, Turkey