Mediterranean wetlands: Natural solutions to deal with climate change

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Many studies have demonstrated the impact of climate change on ecosystems including wetlands. On the contrary, the role of wetlands as an adaptation or mitigation tool is too little studied. Wetlands do mitigate the effects of climate change, helping to reduce the level of greenhouse gas emissions (e.g. carbon sequestration by peatlands) or do provide adaptation services by protecting us from flooding and coastal storms. The Med-ESCWET project, launched by Plan Bleu in 2013, in partnership with Tour du Valat, aims at estimating the economic value of ecosystem services related to climate regulation provided by Mediterranean wetlands.

As shown by IPCC reports, the Mediterranean region is one of the most vulnerable region to climate change and is already experiencing some impacts such as an increase of extreme events (floods, storms, heat waves, droughts...), with significant effect on water resources. Adaptation and mitigation of climate change are therefore major challenges in this region. In parallel, half of all Mediterranean wetlands disappeared during the 20th century and they now only represent 18 million hectares, 1 to 2% of the world's total wetlands (Mediterranean Wetlands Observatory, 2012). Many studies demonstrate the impact of climate change on ecosystems, including wetlands. Nonetheless, it seems that the role of ecosystems as an adaptation or mitigation tool is still little understood and underestimated in countries outside the European Union. When wetlands are not degraded, they can mitigate the effects of climate change, helping to regulate the climate by reducing the level of greenhouse gas emissions (sequestration by peatlands, salt marshes, etc.) or provide adaptation services by protecting us from flooding, drought and coastal storms (lagoons, mangrove swamps, floodplains, etc.). Intact floodplains help limit the risk of flooding by storing water and then releasing it gradually into streams and rivers.

The Med-ESCWET project on "*the economic valuation of ecosystem services provided by wetlands in terms of adaptation to climate change in the Mediterranean*" seeks to promote the adaptation based on wetland ecosystems and to facilitate its integration in national climate change adaptation policies. This three years period project initiated in 2013 by Plan Bleu, in partnership with Tour du Valat, and co-financed by the MAVA and the Prince Albert II of Monaco Foundations, aimed to assess the economic value of ecosystem services related to climate change adaptation and mitigation provided by wetlands around the Mediterranean.

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After a feasibility study, in-depth literature reviews and a consultation process with a range of local leaders and researchers, four wetland areas, each associated with a single ecosystem service, were chosen for the study. The selected wetlands and services were:

• The coastal protection service provided by the Étang de Vic coastal lagoon (Hérault, France);

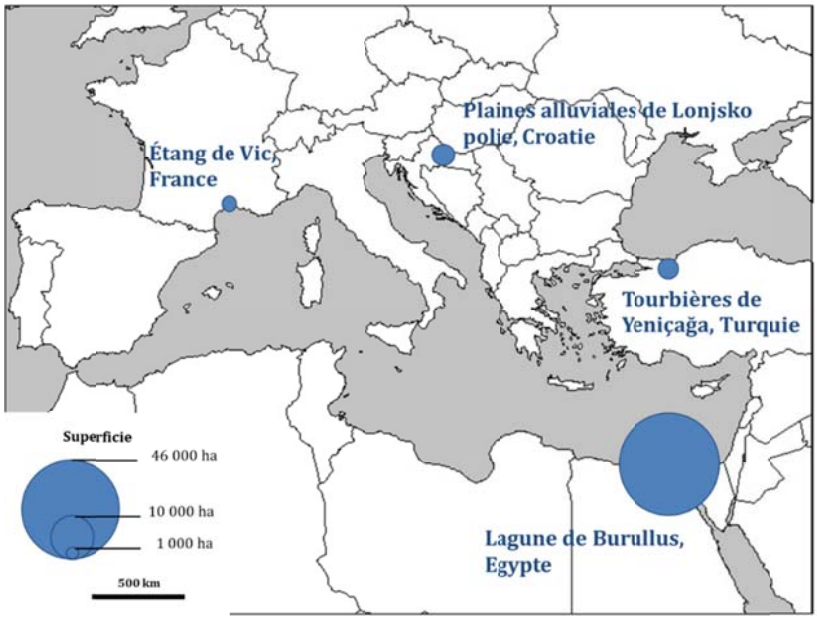
• The flood control service provided by the Lonjsko polje floodplain (Croatia);

• The carbon sequestration service provided by the Yeniçağa peatlands (Turkey);

• The carbon sequestration service provided by Lake Burullus (Egypt).

Analysis of each site involved a biophysical assessment phase and then economic valuation of the ecosystem service.

Figure 1: Location and scale of the pilot sites



As well as offering a new perspective by studying the contribution of wetlands to combating climate change, rather than their vulnerability to climate change, the Med-ESCWET project is original in that it crosses academic boundaries in two ways:

• Economic valuation of ecosystem services is a multidisciplinary exercise, using both biophysical and economic methods and has only recently appeared in the literature;

• In general, the estimated economic value is taken as a “total” value, covering all contributions made by the studied area. The Med-ESCWET project, in contrast, sought to isolate the value of a single ecosystem service provided by each area.

Thus, the study reached the following monetary values, reflecting the specificities of the studied sites and approaches applied, and complement similar exercises already carried out worldwide:

Site & service studied	Considered surface (ha)	Economical method	total value (€ or €/year)	Unit value (€/ha or €/ha/year)
Etang de Vic (France) - coastal protection	1,900	Avoided damages costs	2,273,680 €	1,197 €/ha
Lonjsko polje floodplain (Croatia) - flood control	22,280 (artificial retention basins)	Replacement costs	1,516,272,085 €	68,055 €/ha
Burullus lagoon (Egypt) - carbon sequestration	41,000	Social cost of carbon	45,755,600 €/year	1,116 €/ha/year
Yeniçaga peatland (Turkey) - carbon sequestration	383.4	Marginal abatement cost of carbon	664,967 €/year	1,734 €/ha/year

Despite the methodological limitations mentioned below, this unprecedented exercise has generated some useful and pertinent lessons in terms of methodology and observations, beyond the numerical results of the four valuations.

The final economic value assigned to a service must be interpreted in context. The economic value does not explicitly reflect how effectively the site is managed or its protection status, and this may lead to a distorted interpretation of the importance of the service provided. The value also depends on the selected economic method and the robustness of the prior biophysical assessment. In the Med-ESCWET project, the lowest value was attributed to the service valued for the Étang de Vic lagoon, which is managed in an exemplary manner by the Conservatoire du Littoral to conserve its natural character.

This result reflects the low level of anthropisation, which decreases the estimated value of any impacts, but at the same time 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). 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 activities, not reflecting conservation efforts.

Limitations of this study

The biophysical assessment and economic valuation of ecosystem services in relation to climate change presented is exploratory and rigorous. It is based on a combination of biophysical and economic analyses, adapted to different environments and contexts. Some of the methodological choices made require prudence in interpreting and comparing results from the study:

• An interdisciplinary approach, service by service: the study analysed three different ecosystem services, requiring expertise from a number of different scientific disciplines. Although all ecosystem services were described, in order to properly understand the way each environment functions, 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 function, in size, level of development and anthropisation. The study findings shed light on different environments and services, but are not suitable for comparison;

• An assessment approach using partial data: the studies performed for the Med-ESCWET project are based on data acquired for previous research programmes that had different objectives. Data was therefore only partially available and had to be 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.

Recommendations and perspectives

Conventional approaches encourage global efforts to combat climate change, but do not push national and local authorities and site managers to take responsibility in this struggle. The Med-ESCWET project approach, on the other hand, does contribute to this local accountability. The role of green infrastructure in climate change adaptation was 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 to limit greenhouse gas emissions, and of allowing transit areas in 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 mentioned above, estimates of the total economic value of wetlands could help ensure a better understanding of environmental management issues, via cost-benefit studies for site managers and policymakers, for instance.

This last point highlights one of the major difficulties encountered in many combined science/public policy projects such as Med-ESCWET - it is rare and difficult to get scientists engaged with such strategies.

In concrete terms, 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, or water purification) would help provide an inventory of the various, sometimes poorly understood, environmental protection roles played by Mediterranean wetlands.

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