Economic valuation of ecosystem services provided by Mediterranean wetlands in terms of adaptation to climate change

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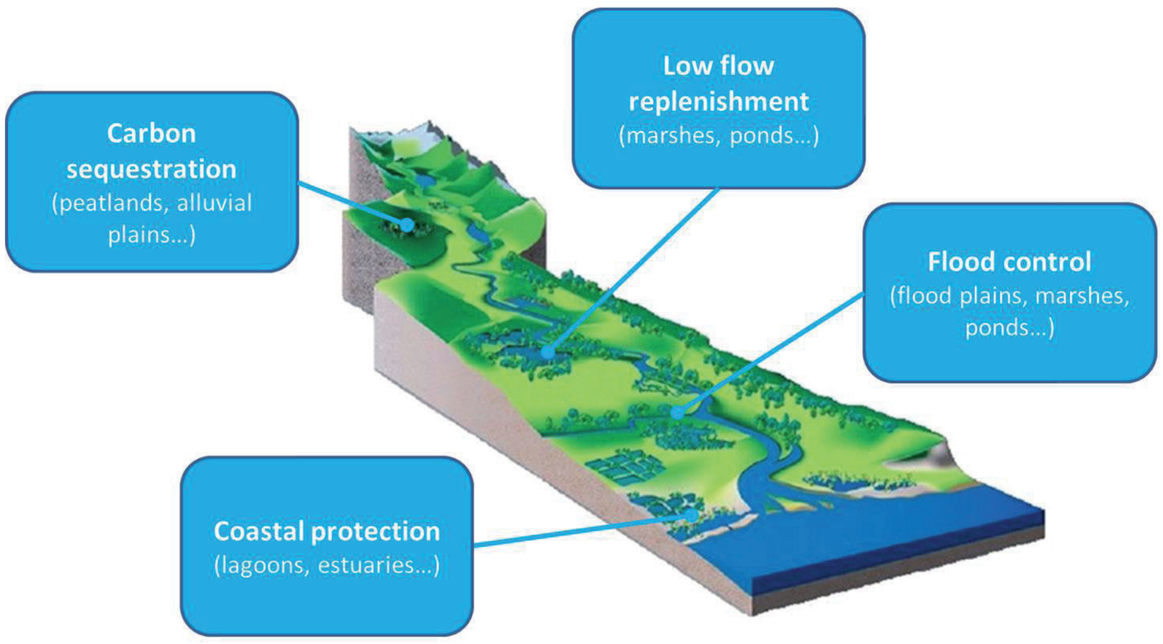
Wetlands act as « climatic buffer »



Source: C. Dubreuil-Imbert, Plan Bleu

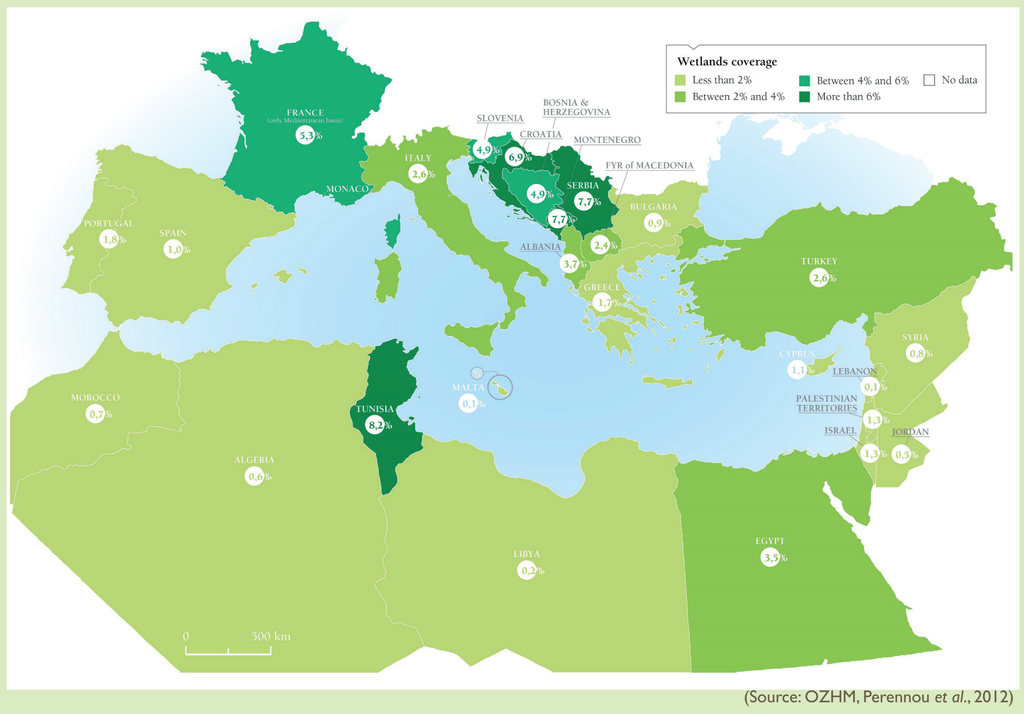
«Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres »
(Ramsar Convention, 1971)

Wetlands deliver a wide range of ecosystem services that contribute to human well-being. The Millenium Ecosystem Assessment (2005) classified the ecosystem services provided by wetlands into four categories:

- *Provisioning* services like food, freshwater and fibre
- *Regulating* services like climate and flood regulation
- *Supporting* services like soil formation and nutrient cycling
- *Cultural* services like spirituality aesthetics, education and recreation

One of the most important roles of wetlands may be in the **regulation of global climate change through sequestering and releasing a major proportion of fixed carbon** in the biosphere. For example, although covering only an estimated 3-4% of the world's land area, peatlands are estimated to hold 540 gigatons of carbon, representing about 1.5% of the total estimated global carbon storage and about 25-30% of that contained in terrestrial vegetation and soils (MEA, 2005). Wetlands, such as mangroves or floodplains, can also play a critical role in the **physical buffering of climate change impacts, such as sea level rise or storms surges. The provision of such services is closely linked to the ecosystem state (damaged or not).**

Mediterranean wetlands: threatened ecosystems in steady decline

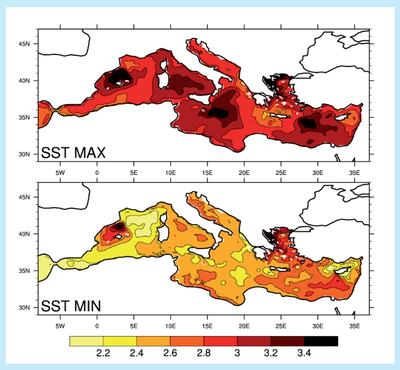


(Source: OZHM, Perennou *et al.*, 2012)

- Since 1900, Mediterranean region has lost about 50% of its wetlands
- Today, about 18 millions ha in the Mediterranean region (1-2 % of world's wetlands)
- Second richest ecosystem in the world in terms of biodiversity and productivity
- The most vulnerable ecosystem to climate change…

… but can also contribute to mitigation and adaptation to climate change!

Mediterranean region: a « hot spot » of climate change



Composite of sea surface temperature anomalies maxima (top) and minima (bottom) for the 2070–2099 period (vs. 1961–1990). Unit: °C (Adloff et al., 2015)

The Mediterranean basin is one of the most vulnerable regions to climatic and anthropogenic changes. Important negative environmental and socio-economic effects are expected. According to a recent study on different socio-economic scenarios, Mediterranean surface waters would warm up from 2 to 4° Celsius by the end of 21st Century (cf. Figure).

Since the late 1970s, mean annual temperatures have increased by 0.1°C per decade and precipitation have decreased by 25 mm per decade (Xoplaki *et al.*, 2004). These trends are set to continue between now and 2050. Temperatures should rise by 1.5–2.5°C and annual precipitation should decrease by 5 to 20% (IPCC, 2007; Milano *et al.*, 2012). These changes should cause an aridification of the Mediterranean climate, sea level rise and an increase of extreme events (droughts, floods, storms…).

By the end of 21st Century:

- Warmer and dryer climate in the Med region
- Increase of extreme events' frequency (e.g. droughts, floods)
- Sea level rise

The role of ecosystems as adaptation tools remains underappreciated and has not been sufficiently studied!

Med-ESCWET project

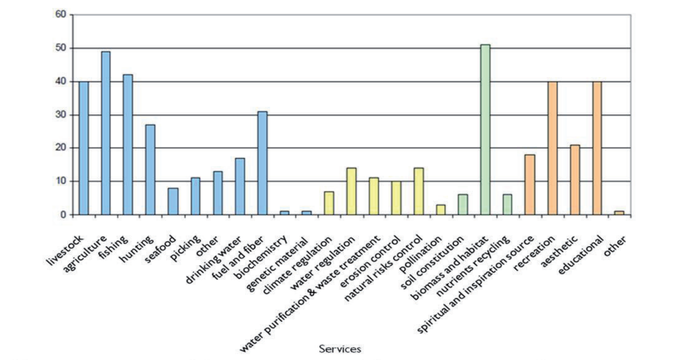
→ Initiated by Plan Bleu in 2013, in partnership with Tour du Valat, this 3 years-project seeks to promote the recognition of the "climatic buffer" role played by wetlands to facilitate its integration in Mediterranean national adaptation strategies to climate change.

Med-ESCWET project aims to (i) improve knowledge of the services and benefits provided by wetlands in climate regulation; and (ii) to economically assess regulating services based on four Mediterranean case studies, to facilitate decision-making in terms of adaptation strategy to climate change.

→ Why an economic valuation of ecosystem services?

- Since ecosystem services are not traded in commercial markets, they are often given too little or no weight in decision-making;
- Economic valuation is a tool for valuing ecosystems and their services in monetary terms. It quantifies the benefits provided by ecosystems and the impact of ecosystem changes on the wellbeing of people;
- It creates a common language for policy-makers, business and society;
- It gives economic arguments for integration of ecosystem services in development planning;
- It allows evaluating trade-offs between different ecosystem management options and choosing between competing uses, e.g. land use.

Few existing economic valuation studies of regulating ecosystem services provided by wetlands in the Mediterranean



Graph: Distribution of economic valuation studies of ecosystem services provided by wetlands in the Mediterranean Basin by type of service analyzed (Source: translated from OZHM, 2010)

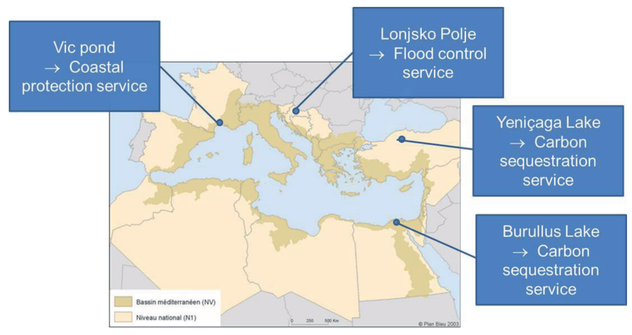


Figure: Four combinations wetland/regulating service selected in Med-ESCWET project

→ How to value regulating ecosystem services?

A variety of economic valuation approaches exist to quantify all or parts of total economic value of an ecosystem service. Methods which may be used for regulating services studied in Med-ESCWET project are listed in Table below.

Method	Assessed regulation service	Description	Main advantages	Limitations
Revealed preference				
Direct assessment				
Market price	Carbon sequestration	Exchange value of ecosystem service on the market.	Market data easily available ; Simple technique.	Inexistent markets for most services. Imperfect markets create price distortions. Prices do not reflect social importance. Effects on price have to be considered (seasons, socio economic characteristics, subsidies and taxes ...).
Indirect assessment				
Avoided cost	Flood Control Low water support Coastal protection	Costs that the community should support in the absence of a particular ecosystem service.	Reflects current arbitrations.	Frequency and intensity of events difficult to predict. Damages estimated are hypothetical and links with ecosystem service change are uncertain. Risks of over / under-estimation.
Replacement cost	Carbon sequestration Flood Control Low water support Coastal protection	Cost of artificial substitute systems of one or more ecosystem service(s).	Reflects current arbitrations; Relatively simple data collection.	Impossibility of identifying perfect substitutes for ecosystem services. Risk of under / over-estimation.
Other method				
Benefit transfert	Carbon sequestration Flood Control Low water support Coastal protection	Use of results from existing studies to estimate the value of a particular service, sometimes in conjunction with local data.	Useful technique when few data are available, when the financial and human resources are limited. Rapid application.	Values can be very inaccurate, as many factors vary even when contexts seem 'similar'.

Source: Plan Bleu - adapted from Barbier et al. (1997) ; de Groot et al. (2007) ; Emerton et Bos (2004) ; Mavsar et al. (2013) ; Secretariat of the CBD (2009)

▶ In the face of natural hazards, becoming more frequent and severe with climate change, human-made protection infrastructures had not always the intended effects or even exacerbated negative effects (e.g. dams which alter erosion dynamics or sediment deposition).

Wetlands can offer an effective alternative at a lower cost, which should be taken more into account in adaptative management policies. Conservation and restoration of wetlands are key actions to increase resilience to climate change !

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