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Tackling climate change impacts to help practitioners in wetlands conservation

Mediterranean wetlands and their contribution to human well-being are at risk

Wetlands have been declining worldwide over the last century, with climate change becoming an additional pressure, especially in regions showing water deficit. Within the ECOPOTENTIAL H2020 project, the partners *Tour du Valat (FR)* and Institute of Atmospheric Sciences and Climate of the *National Research Council of Italy* (ISAC-CNR) investigated how climate change would affect seasonal wetlands across the Mediterranean basin. These ecosystems provide sheltered and nutrient-rich refuges for various animal species, provide building materials and contribute to water purification and flood retention.

Country	Current	RCP 4.5	RCP 8.5
Albania	-731	-803	-950
Algeria	-802	-1101	-1346
Bosnia & Herzegovina	-800	-929	-1117
Croatia	-796	-819	-1016
Cyprus	-965	-1320	-1469
France	-820	-915	-1085
Greece	-936	-1133	-1369
Israel	-1169	-1575	-1874
Italy	-753	-818	-1019
Lebanon	-835	-1075	-1372
Libya	-1015	-1241	-1388
Macedonia	-571	-728	-1002
Morocco	-883	-1437	-1785
Palestinian territory	-1203	-1362	-1633
Portugal	-912	-1245	-1655
Spain	-817	-1116	-1390
Syria	-1227	-1559	-1764
Tunisia	-906	-1146	-1345
Turkey	-772	-1054	-1222
All localities	-849	-1088	-1321

Table 1: Water stress (mm) of wetlands today and under the scenarios RCP 4.5 and RCP 8.5 in 2100

Combining climate, hydrology and ecology models to apprehend the future of wetlands

Climate projections at the 2050 and 2100 time horizons, based on two greenhouse gas emission scenarios (RCP4.5 & RCP8.5), were extracted at 229 localities around the Mediterranean sea[1]. These data were integrated into Mar-O-Sel.net, a free online software developed to promote rational use of Mediterranean marsh (Lefebvre et al. 2015). We first parameterized a seasonally-flooded wetland under current climate conditions by setting iteratively catchment area, overflow level and water table depth at each locality. Second, we simulated the future state of these virtual wetlands based on the precipitation and evapotranspiration at 2050 and 2100. Wetland evolution was estimated based on ecological thresholds (flooding duration and frequency).

Keywords:

Mediterranean Basin, adaptive management, seasonal emergent marsh

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Software:

www.mar-o-sel.net

[1] Climate projections from the Rossby Centre RCA4 Regional Climate Model driven by the MOHC-HadGEM2-ES Global Climate Model (available under EURO-CORDEX)

Info: Brigitte Poulin <poulin@tourduvalat.org>

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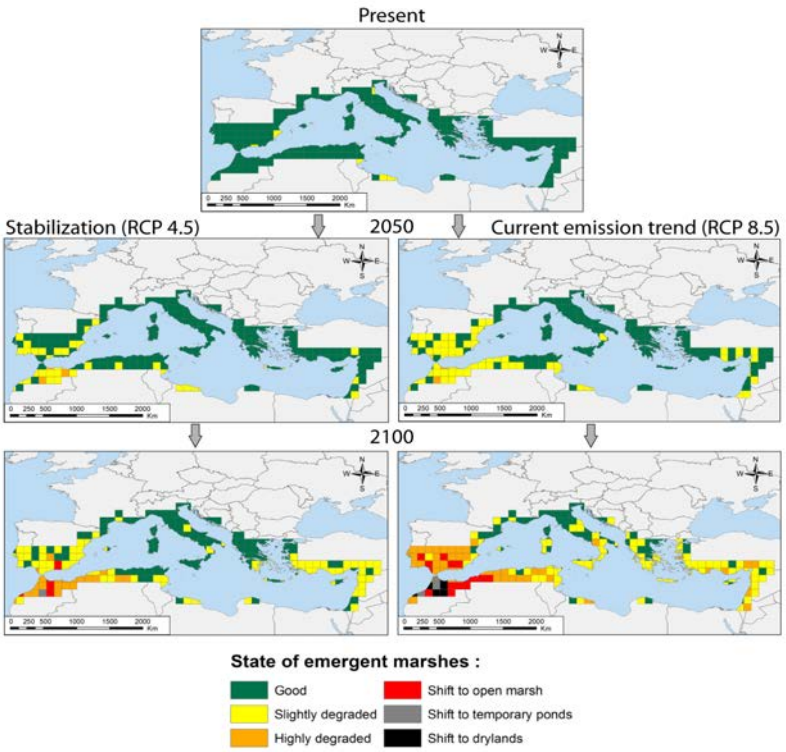

Fig. 1: Expected habitat change of seasonally-flooded marshes under the greenhouse gas emission scenarios RCP 4.5 and RCP 8.5 in 2050 and 2100.

From global climate models to wetland impact assessment

Simulations showed that water deficit will increase heterogeneously across the Mediterranean area (Table 1). Currently, 97% of localities could have wetlands in good state. By 2050, however, this proportion would decrease to 81% and 68% under the RCP 4.5 and RCP 8.5 scenarios, respectively, decreasing further to 52% and 27% by 2100 (Fig. 1). Countries at higher risk of wetland degradation and loss are Algeria, Morocco, Portugal and Spain. The amount of water needed annually to avoid degradation would vary from 1055 m^3/ha for slightly degraded sites to 3537 m3/ha for a wetland collapsing into dry land.

Adapting management and territorial planning to the wetland resilience thresholds identified in this study should be a priority on the political agenda: save the wetlands, save the people!

From wetland impact assessment to proactive management

Despite the abundant literature predicting the effects of climate change on ecosystem functions and species' ranges, climate change models are rarely incorporated into restoration and conservation plans because they are not developed at the proper spatial and temporal scales for managers. The software (mar-o-sel.net) used in this study, instead, allows practitioners testing different management scenarios depending on water availability, to help reduce non-climate stressors.