Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem
Together for the Mediterranean Sea
MedPartnership
GEF UNEP

Experience Note

Photo: L.-M. Preau / Initiative PIM

Assessment of climate variability and change impacts and evaluation of response options - case study of Tunisia

AT A GLANCE

The "*Integration of climatic variability and change into national strategies to implement the ICZM Protocol in the Mediterranean*" project ("***ClimVar & ICZM***") is a collective effort to promote the use of Integrated Coastal Zone Management (ICZM) in countries sharing the Mediterranean as an effective tool to deal with the impacts of climate variability and change in coastal zones, by mainstreaming them into the ICZM process. It was adopted in January 2012 and will be completed in late 2015.

The project is led by UNEP/MAP, within the framework of the MedPartnership project. Its executing partners are PAP/RAC, Plan Bleu/ RAC and GWP-Med.

Participating countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Libya, Morocco, Montenegro, Palestine, Syria and Tunisia.
Total budget: USD 9.2 million.
USD 2.2 million: Global Environment Facility; USD 7 million: Participating countries, executing agencies, and donors.

ABSTRACT

Tunisia is considered as one of the Mediterranean countries most vulnerable to climate variability and change, and particularly to sea-level rise and storm surges. The coastline of Tunisia is more than 1,700 km long, including the continental part and the islands, with a variety of coastal types. Its coastal wetlands, which are located at a very low level, are of particular concern. This activity will help evaluate the future costs expected to occur in coastal zones, in terms of assets and persons impacted, if the current practices in coastal management remain unchanged and under different development scenarios. The Dynamic Integrated Vulnerability Assessment (DIVA) model is intended to highlight the need for and support future adaptation policies in coastal management. The DIVA modelling framework is used to assess the increased coastal flood risk in terms of the expected annual damage from extreme sea-level events and dry land loss due to sea-level rise.
The first results of the assessment are in agreement with the vulnerability trends identified by the Tunisian experts studying the impacts of the sea-level rise. The sea-level rise will be significant across the century, and adaptation measures are required. Results show that hard defence construction and continuous beach nourishment would be economically beneficial compared to “do-nothing” approaches.

PAP/RAC

ACTIVITY DESCRIPTION

The DIVA model is largely recognised in climate science as a key tool to estimate the economic costs of climate variability and change (CVC) with focus in coastal regions. The model was applied in two countries – Croatia and Tunisia. All partner countries were invited to apply if they could guarantee the necessary input data. Based on the selection criteria, Tunisia and Croatia were selected. In Tunisia, preliminary results were presented in 2014, while the final results will be published in 2015.

THE EXPERIENCE

The DIVA model was downscaled at national level in Tunisia. Since the democratic uprising in 2012, the institutional and political background has been constantly evolving. However, the data and information exchange between the DIVA team and its Tunisian counterparts, under the Tunisian Coastal Agency (APAL), has been continuous and productive.

Photo: L.-M. Preau / Initiative PIM

Methodology

DIVA is an integrated, global research framework for assessing the biophysical and socio-economic consequences of sea-level rise and associated extreme water levels under different physical and socio-economic scenarios that considers various adaptation strategies. The general approach of the DIVA segmentation was applied to the Tunisian coasts and included:

- elements of the coastline, such as coastal types, plain, river mouth and lagoon;
- population density and
- administrative units.

The Tunisian DIVA segmentation of the coast constitutes the data model for a spatial data base that includes more than 80 physical, ecological and socioeconomic parameters. The initial global DIVA segmentation represented Tunisia with 35 segments; with the downscaled Tunisian DIVA segmentation a total of 564 segments were defined.
The preliminary results provided by the Global Climate Forum and the University of Kiel were based on the processing of open source and online available data (i.e., coastal type, coastal plain, river mouth, population, administration unit, lagoon). The following key inputs were used to define DIVA in Tunisia:

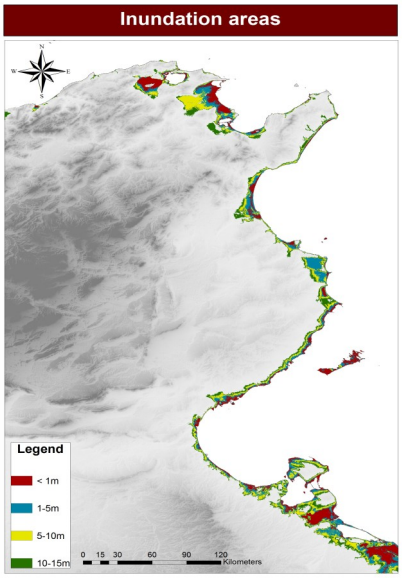
Coast length: 2,151 km; erodible coast length: 486 km
Current (2015) exposure below 2m:
- People: 384,785
- Assets: USD 8.9 billion
- Area: 8,463 km²

Current (2015) exposure below 100-year flood:
- Average height of 100-year flood: 1.58 m
- People: 304,732
- Assets: USD 6.8 billion
- Area: 1,461 km²

Coastal administrative Units: 78

The final results provided by the Global Climate Forum and the University of Kiel combine preliminary results and inputs form the Tiunisian partners, essentially GIS data provided by APAL.

RESULTS



Inundation areas in Tunisia

<u>Flooding is an issue in Tunisia</u> (exposure):

- 443km² of the Tunisian coastal zone is currently exposed to the 1-in-100 year coastal extreme water level;
- 21st century sea-level rise (RCP 8.5) would increase this area to 1,666km²;
- Médenine is the municipality with the biggest potential 100-year floodplain, followed by Bizerte and Sfax;
- Tunis, Ben Arous and Sfax have the highest asset values and population in the potential 100-year floodplain;
- Worst case in 2100: up to 436,000 people flooded annually, annual cost of up to USD 22.1 billion;

- Damages are mainly concentrated in Sfax, Tunis and Ben Arous;
- Impacts can be reduced significantly when applying appropriate adaptation measures (Avoided annual flood damages in 2100: US$ 19,00 – 49,428 million due to adaptation via dikes);
- Up-front investments of US$ 18.8 billion to build initial dikes for about 86% of Tunisia's coastline plus annual investment and maintenance costs increasing from US$ 169 million per year in 2100 to US$ 219-302 million at the end of the century would be required. Protection by dikes will not be very attractive for tourism.

<u>Erosion is an issue in Tunisia:</u>

- Without adaptation: annual land loss of up to 522,755 m² (around 1/3 of the Tunisian coastline consists of erodible beaches);
- Municipalities most affected by erosion are Nabeul, Soussè, Médinine and Bizerte;
- Adaptation (beach nourishment) in 2100 would cost about USD 43.82 million annually and up to 7,2 km² of sand;

LESSONS LEARNED

After presenting the preliminary results, the partners agreed to push forward with the DIVA Tunisia modelling. Further analysis, to be completed in June 2015, will be based on the integration of more specific data forwarded by the Tunisian partners. A list of comments will illustrate (i) the value of data provided (e.g. more details on the coastal types, etc.), (ii) steps beyond the final results, and (iii) guidelines for future cooperation.

Greater involvement of Tunisian partners in the early stages of the socio-economic evaluation of CVC impacts would guarantee better adaptation of the model as a decision-making tool suited to local needs and capacity improvement.

It will be important to enhance local expertise (i.e. inundation modelling, harbour development analysis, etc.). Other areas for further cooperation were also identified. Brief recommendations should provide insight into what can be done and will provide "material" to sustain the discussion with the Tunisian partners on further cooperation.

IMPACTS

First results of the DIVA model were presented in 2014 to 30 senior Tunisian experts in coastal zone management and representatives of national research institutions and organisations, such as the National Institute for Marine Studies, the National Institute of Meteorology, and the National Coastal Agency. Great interest was shown in the technical aspects of the DIVA model.

After the meeting, it was decided to work on a more detailed analysis using available Tunisian data. The latest findings of DIVA Tunisia will be presented at the MedPartnership Final Conference on ICZM in Split on 12-13 May 2015. A study on CVC impacts per sector in Tunisia was launched in cooperation with the Pr. Markandya, for which a Tunisian expert was hired to gather and analyse the data (results are expected in June 2015).

Because of the interest shown in Tunisia and by partners in the project countries, a regional DIVA training session will be organised. This meeting will be an opportunity to discuss the methodologies and results of the evaluation of socio-economic CVC impacts on coastal zones.

Photo: S. Petit

REFERENCES

Priority Actions Programme/Regional Activity Centre (PAP/RAC)
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KEYWORDS

climate change; sea level rise; coastal flooding; coastal management; adaptation; resilience; mitigation

EXECUTING PARTNER

PAP/RAC was established in 1977 in Split, Croatia, as part of the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP). PAP/RAC's mandate is to provide support to Mediterranean countries in the implementation of the Barcelona Convention and its Protocols, and in particular of the Protocol on Integrated Coastal Zone Management. PAP/RAC is oriented towards carrying out of activities contributing to sustainable development of coastal zones and strengthening capacities for their implementation. Thereby, it co-operates with national, regional and local authorities, as well as with a large number of international organisations and institutions.

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