Adaptation of Mediterranean Coastal Zones to the Impacts of Climate Change: The Plan Bleu Tools

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The Mediterranean Basin: a Climate Change Hotspot Subject to Multiple Anthropogenic Pressures

According to the latest estimates, in 2016 180 million people live on the shores of the Mediterranean basin, about 17% more than in 2000. This figure climbs to more than 200 million when annual tourist arrivals are included. These international tourist arrivals in the Mediterranean region account for one third of global international tourism, and, according to Plan Bleu projections, coastal tourism will only continue to increase over the next 15 years. The future development of the Mediterranean tourism industry will be influenced by many factors, including the diminishing competitiveness of certain destinations, changes in tourists' expectations and needs and the growing impact of climate change.

This semi-enclosed sea, with its unique environmental, cultural and heritage characteristics, makes up less than 1% of the global ocean surface but is home to between 4 and 18% of known marine flora and fauna. The impacts linked to climate variation and change (CVC) thus add to the region's already significant anthropogenic pressures.

The Mediterranean Sea has also been identified as a climate change hotspot by the Intergovernmental Panel on Climate Change (IPCC). The European Environment Agency has identified rising sea temperatures as the most significant climate change impact for the Mediterranean. An average increase in the temperature of +0.74°C has been registered since basin-wide measurements first began to be taken in the 19th century. According to climate projections, this increase could reach +1.5°C in the most heavily affected zones, such as in the north of the Balearic Islands.

Several marine ecosystems in the Mediterranean have already been affected by this increase in sea surface temperature. One of the most significant consequences is the changes in geographical distribution of species. Overfishing in the Mediterranean, along with the effects of climate change, is modifying both the spatial distribution and the productivity of marine species. This results in uncertainty regarding fisheries management and ecosystem protection in coming years.

The acidification of oceans is the second most significant pressure related to climate change.

The gradual increase in the ocean's acidity is primarily due to the absorption of carbon dioxide (CO_2) from the burning of fossil fuels; the gas is released into the atmosphere and dissolves in the ocean, changing its chemical composition. Should CO_2 emissions continue at the same pace as in the last decade, there would be an increase in acidity of 30% by 2050 and 150% by 2100.

One of the measurable impacts is the phenomenon of erosion, which is accelerating due to the rise in sea level, itself a consequence of climate change. In this regard, Plan Bleu has shown that about half of the 46,000 km of Mediterranean coastline is subject to problems of coastal erosion, albeit with large disparities between countries.

Coastal erosion can, however, be mitigated through ecosystem-based management techniques (ecosystem approach and services), especially through the conservation, maintenance and restoration of key natural ecosystems (dunes, marshes and coastal lagoons).

PLAN BLEU: A CENTRE FOR ENVIRONMENTAL OBSERVATION AND IMPLEMENTATION OF THE BARCELONA CONVENTION ON THE MEDITERRANEAN

The 1976 Barcelona Convention, amended in 1995, seeks to protect the marine environment and coastline of the Mediterranean whilst at the same time encouraging regional and national plans that contribute to sustainable development. It is coordinated by a UNED coordination unit based in Athens. Six Mediterranean countries host Regional Activity Centres, which contribute in their respective fields to the convention's implementation. Plan Bleu is one such centre, and its mission is defined as follows:

"Within the context of the Barcelona Convention, Plan Bleu plays the dual role of environmental and sustainable development observatory centre and systematic and prospective analysis centre. Its aim is to raise the awareness of Mediterranean stakeholders and decision-makers about problems related to the environment and the region's sustainable development by providing them with future scenarios to assist with decision-making."

Plan Bleu is thus an interface between scientists and decision-makers in the Mediterranean in the field of the environment and sustainable development. As such, it strives to ensure that all relevant information is synthesized, analysed, discussed and made available to decision-makers.

The areas of expertise under Plan Bleu include climate change and integrated coastal zone management (ICZM).

The IPCC's fifth assessment report identified the Mediterranean as one of the regions most vulnerable to climate change, noting that it "will experience multiple systemic constraints and failures due to climate change in the coming years." Adaptation to climate change in the Mediterranean is thus essential. In this field, Plan Bleu's role takes the form of specific actions, such as the organization of workshops and the development of tools. The participative workshops encourage and facilitate both the exchange of knowledge between climate experts and information users and the development of joint strategic recommendations.

Through its publications, Plan Bleu formulates strategies and recommendations for managing risks and opportunities in key socio-economic and environmental sectors. Plan Bleu's leading publications on climate risk management primarily deal with the water sector, but also wetlands, energy, transport, agriculture and, more recently, coastal zones.

For more information: http://planbleu.org

As this overview of the main pressures (climatic and anthropogenic) affecting the Mediterranean shows, the region is facing a number of risks. Plan Bleu aims to develop tools to support measures designed to adapt coastal zones to climate change.

Examples of Tools and Instruments Implemented at the Regional Level by Plan Bleu for the Adaptation of Mediterranean Coastal Zones to Climate Change

Between 2012 and 2015, Plan Bleu partnered on the project "Integration of climate variability and change into national strategies to implement the Integrated Coastal Zone Management (ICZM) protocol in the Mediterranean," which aimed to promote adaptation to the impacts of climate change in coastal zones, integrating them in spatial planning processes.

To this end, Plan Bleu has developed tools to support the decision-making process.

— Calculation of a Coastal Risk Index

Based on the concept of "risk" as defined in the IPCC's fifth report, Plan Bleu, in partnership with Acclimatise[1] and its Associates,[2] has developed a robust and relatively simple scientific method to identify the Mediterranean coastal zones at greatest risk in terms of CVC-related physical and socio-economic impacts.

Based on the combination of three sub-indices (coastal forcing, coastal vulnerability and coastal exposure) and 18 associated variables, this index (http://planbleu.org/sites/default/files/publications/notes28_fr.pdf) was designed as a tool to assist with decision-making, facilitating the analysis of the physical impacts of CVC and the consequences for socio-economic sectors and coastal ecosystems.

It was calculated nationally for eleven countries and for the coastal zone of Tétouan in Morocco. Through the assignment of a score and weighting to each variable, the index can be calculated at different scales, making it possible to identify those coastal zones for which adaptation measures should be prioritized.

— The role of climate services: illustration with the Mediterranean Integrated Climate Information Platform (MedICIP)

Although decision-makers in the main climate-dependent sectors are interested in managing their climate risks, there is a lack of information

[1] www.acclimatise.uk.com/

[2] www.medseafoundation.org/ and www.facebook.com/ClimaliaEU/

and a need for reliable and directly actionable climate data to support them in the process of adapting to CVC.

Actionable data drawn from optimized climate observations, predictions and projections must be provided in order to promote a climate-resilient society and to prevent the potential socioeconomic damage that may derive from CVC. It is not enough to improve climate knowledge alone to strengthen societal resilience and adaptive capacity to CVC. It is also necessary to create more climate services and products that can be used directly to help with decision- and policy-making.

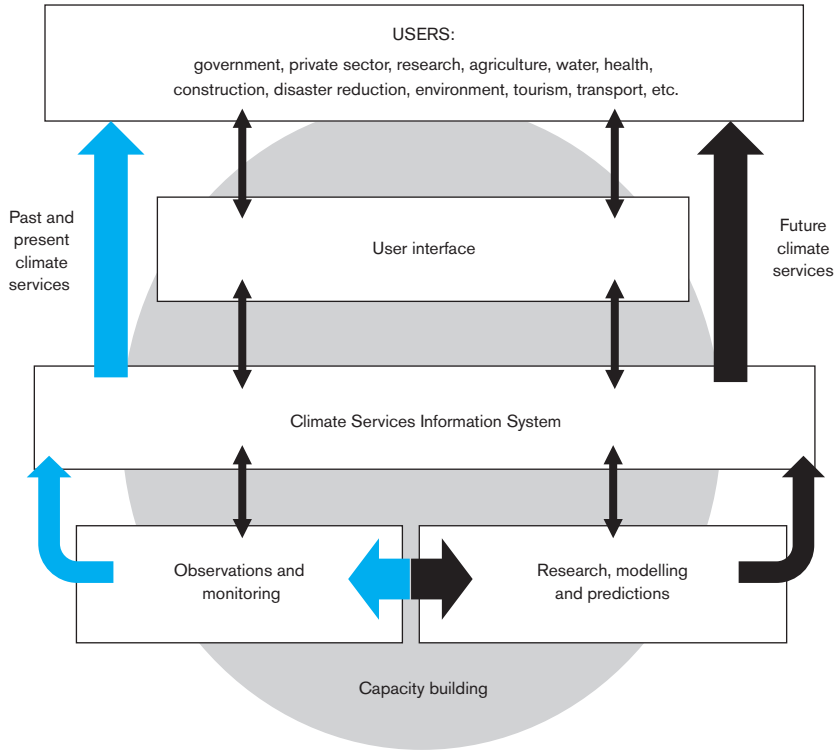
The Global Framework for Climate Services (GFCS), launched by the World Meteorological Organization (WMO) at the World Climate Conference in 2009 (Chart 16), was set up to meet this demand.

A climate service can be defined as the "timely production and delivery of useful climate data, information and knowledge to decision-makers to enable them to assess the impacts of climate change on socioeconomic activities and the environment or even take mitigation and adaptation measures" [NAS, 2001]. The services and products generated and delivered by a climate service can be considered as a gradually increasing integration of climate information, including "raw" climate data (e.g. observations, models), elaborated data (e.g. indices), elaborated products (e.g. diagrams, static and/or interactive maps, probabilistic products), and documents and tools (e.g. illustrative adaptation measures, tools for supporting decision-making such as business assessment tools or local climate impact profiles).

The development of the Mediterranean Integrated Climate Information Platform (http://medicip.grid.unep.ch/) is one example of the interface between data providers and users.

MedICIP was developed jointly by Plan Bleu and the UNEP/GRID-Geneva. Its primary goal is to share climate information prepared in different formats: documents, reports, studies, and layers of geographical information in Geographic Information System (GIS) format related to the impacts of climate change on coastal zones.

CHART 16 **Components of the Global Framework for Climate Services (GFCS)**



Source: WMO and GFCS.

MedCOP 21: a Large Civil Society Forum Devoted to a Climate Change Adaptation Agenda

Within the context of the 21st Conference of Parties to the United Nations Framework Convention on Climate Change, the French region of Provence-Alpes-Côte d'Azur hosted MedCOP 21 on 4 and 5 June 2015. Plan Bleu actively participated in the event, conceived as "a forum for stakeholders from Mediterranean civil society." MedCOP 21 made it possible to support, in the spirit of an agenda of solutions, all supplementary initiatives to the international agreement, undertaken at the local and regional level by civil society stakeholders to strengthen states' commitments with regard to the reduction of greenhouse gas emissions, adaptation to the impacts of climate change, and funding mechanisms. With the aim of contributing to the construction of a true positive Mediterranean agenda, the event reached beyond current constraints to seize the opportunities that adaptation to climate change might provide.

The Paris Agreement is not enough to solve the problem of climate change, but it did allow states to reach a consensus in the shadow of the main players in economic globalization

Today, climate change is no longer in doubt, and less so in the Mediterranean. Awareness of the losses and damages caused by the extreme phenomena impacting numerous countries is relatively recent. MedCOP 21 and COP 21, expected to lead to binding obligations, primarily served to recall the goals defined at the 1992 Rio Summit, setting dates and conditions for the implementation thereof. In its current form, the Paris Agreement is not enough to solve the problem of climate change, but it did allow states to reach a consensus in the shadow of the main players in economic globalization.

In this context, Plan Bleu acts at the Mediterranean level, co-developing tools with the Contracting Parties to the Barcelona Convention and to the Mediterranean Action Plan and proposing recommendations for strategic actions.

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