Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem
MedPartnership

PNUE

"Integration of climate variability and change into national strategies to implement the ICZM protocol in the Mediterranean"

Deliverable on activity 1.1.3.1:"Identify a set of Climate Variability and Change indicators"

Final version

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Introduction

The 2012-2013 MAP Programme of Work (PoW), adopted at the COP in February 2012 in Paris, mentions the issue of climate change as orientation guidance for design and implementation of its activities. The Project is well integrated in the work of MAP components that contribute to this project (PLAN BLEU and PAP). One of the themes of the MAP's PoW is Theme VI: Climate change. The PoW envisages activities to analyse climate change impacts on economic sectors and resources and urges for indicators to be developed to assess climate change impacts on coastal zone development.

Therefore, since January 2012, UNEP MAP and some of its Regional Activity Centres are involved in a regional project called "Integration of climate variability and change into national ICZM strategies", an additional part of the MedPartnership project[1]. Within the framework of this project, Plan Bleu is overseeing an activity that focusses on the « Identification of a set of coastal zone climate variability and change indicators".

To achieve the expected results of the project, Plan Bleu has analysed national and regional reports from the preparation phase of the project. Plan Bleu also organized seven national workshops with relevant national experts in Albania, Algeria, Bosnia & Herzegovina, Egypt, Montenegro, Morocco and Palestine.

At the Mediterranean level, the issue of indicators is crucial and Plan Bleu, with the UNEP MAP system, has been working on this for several years, especially within the framework of the Mediterranean Strategy for the Sustainable Development (MSSD). With the support of contracting parties of the Barcelona Convention, Plan Bleu has developed a set of 34 priority indicators that address several topics such as water resources management, energy demand and the mitigating effects of climate change, sustainable mobility and transport, tourism, agriculture and rural development, urban development, sustainable management of seas and coasts, improving solidarity, commitment and funding, human capital and the involvement of stakeholders.

In accordance with CoP 18 (Ankara, Turkey, 1-3 July 2013), UNEP MAP and Plan Bleu launched a revision of the MSSD in 2014. This regional context is a great opportunity for this study to feed the reflections related to the indicators portion of the MSSD, at least, regarding "climate change" and "coastal zone".

- Beneficiaries of the regional core set of indicators

The main objective of the regional core indicators is to allow the follow-up of the adaptation policies to climate variability and change at the regional level and to take specific national coastal challenges into consideration. So, the geographical unit considered by the regional core set is the coastal region given by the Barcelona Convention' ICZM protocol. Some indicators concern the hinterland and watershed basin and others the marine part of the coast. The proposed core set of indicators is therefore designed for the regional level (Mediterranean basin) and each indicator can be calculated at the national level.

UNEP MAP confirms that the regional core set of indicators is intended for Mediterranean governments as its mandate is to serve them. In this way, UNEP MAP supports the implementation and follow-up of several plans through projects dealing with CVC (at the regional level through the Regional Framework for Adaptation to Climate Change[2] and local levels, as was the case in Sibenik-Knin county, Croatia in another activity of the ClimVar project. It is therefore important to specify that UNEP MAP developed its 5-year strategic programme of work by paying special attention to the issues related to CVC in the Mediterranean. Moreover, as described above, UNEP MAP, with the strong support of Plan Bleu has begun revision of the MSSD.

1 http://www.themedpartnership.org/
2 This framework should assess the key impacts of CVC and propose strategies to incorporate them into the national ICZM plan.

The preliminary core set of indicators comes from 7 National workshops that were moderated by Plan Bleu and National Focal Points in Algeria, Morocco, Egypt, Palestine, Montenegro, Albania, Bosnia & Herzegovina between April and November 2013. During the meetings, experts expressed the issues they faced and indicators they needed.

The needs and concerns expressed by the countries regarding the core set of indicators are shown below. They were highlighted during national workshops in 2013.

Country	Needs and concerns
Egypt	1. "Governance category" requires more quantification of indicators. 2. "Governance category" indicators should have specific quantification guidelines. 3. It is necessary to establish guidelines for monitoring each and every indicator and make it available for dialogue and discussions at the regional level
Montenegro	In order to define the indicators of interest, there needs to be consistency with other relevant data and indicators (e.g. National list of indicators, ECAP, EEA core set of indicators, AdriCosmStar data, CAMP).
Algeria	There is a difference between data and indicators, and between indicators and composite indexes. Creating composite indexes whenever possible should be an objective.

- Indicators of interest within the framework of the UNEP MAP EcAp initiative:

The 15th Conference of the Contracting Parties (COP15) to the Barcelona Convention (Almeria, Spain, 2008) decided (through Decision IG.17/5) to progressively apply the ecosystem approach (EcAp) to the management of human activities that may affect the Mediterranean marine and coastal environment for the promotion of sustainable development (UNEP/MAP, 2007).

The 17th Conference of the Contracting Parties (COP17, Paris, France, 2012) confirmed the importance given to the EcAp in the Mediterranean, by recognizing it as a guiding principle for the overall work under the Barcelona Convention. In addition, the Contracting Parties agreed (through Decision IG.20/4) on an overall vision and goals for EcAp, on 11 ecological objectives, operational objectives and indicators for the Mediterranean, adopted the timeline for implementing the ecosystem approach until 2019 and established a six-year cyclic review process of its implementation, with the next EcAp cycle to cover 2016-2021 (UNEP/MAP, 2012).

Of the most recent milestones, at the 18th Meeting of the Contracting Parties to the Barcelona Convention (COP18), targets for achieving GES of the Mediterranean Sea and its coastal zone by 2020 were adopted. In addition, through Decision IG. 21/3 (the so called "COP18 EcAp Decision"), the Contracting Parties also agreed to design an Integrated Monitoring and Assessment Programme by the end of 2015, starting its implementation from 2016, and mandated the Secretariat to carry out an assessment of the state of the Mediterranean environment in 2017 (UNEP/MAP, 2013).

The following indicators stem from the EcAP initiative and are in accordance with the theme of this report.

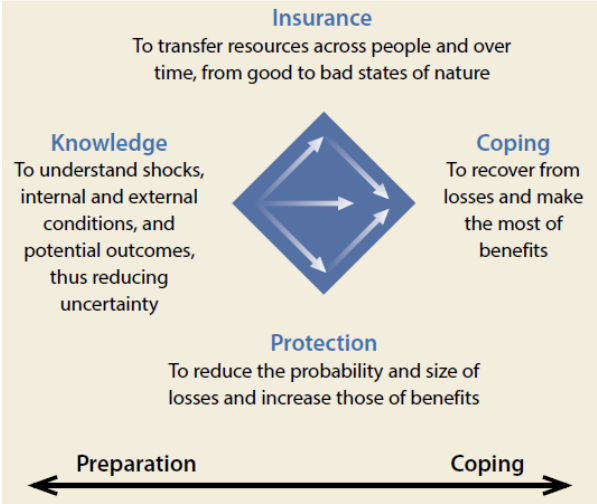
Table 1. Indicators of interest for the CVC and ICZM themes linked to the EcAp's operational objectives and Good Environmental Status

Operational objective	Indicator	Good Environmental Status
1.4 Key coastal and marine habitats are not being lost	1.4.2 Distributional pattern of certain coastal and marine habitats listed under SPA protocol	The distributional extent is in line with prevailing physiographic, hydrographic, geographic and climatic conditions.
1.2 Population size of selected species is maintained (marine mammals, birds, reptiles)	1.2.1 Population abundance	The species population has abundance levels allowing them to qualify as IUCN least-concern species
2.1 Invasive non-indigenous species introductions are minimized	2.1.1. Spatial distribution, origin and population status (established vs. vagrant) of non-indigenous species	Introduction and spread of NIS linked to human activities are minimised, in particular for potential IAS
	2.1.2 Trends in the abundance of introduced species, notably in risk areas	Decreasing abundance of introduced NIS in risk areas
2.2. The impact of non-indigenous particularly invasive species on ecosystems is limited	2.2.1 Ecosystem impacts of particularly invasive species	No decrease in native species abundance, no decline of habitats and no change in community structure that have been generated by IAS via competition, predation or any other direct or indirect effect.
	2.2.2 Ratio between non-indigenous invasive species and native species in some well-studied taxonomic groups	Stable or decreasing proportion of NIS in the different habitats
7.1 Impacts to the marine and coastal ecosystem induced by climate variability and/or climate change are minimized	7.1.1 Large scale changes in circulation patterns, temperature, pH, and salinity distribution	Ecosystems are resilient enough to adapt to climate change.
	7.1.2 Long term changes in sea level	
7.2 Alterations due to permanent constructions on the coast and watersheds, marine installations and seafloor anchored structures are minimized	7.2.1 Impact on the circulation caused by the presence of structures	With new structures in place, near shore wave- and current patterns remain as natural as possible.
	7.2.2 Location and extent of the habitats impacted directly by the alterations and/or the circulation changes induced by them: footprints of impacting structures	Negative impacts due to new structures are minimal with no influence on the larger scale coastal and marine system
8.1 The natural dynamic nature of coastlines is respected and coastal areas are in good condition	8.1.1 Areal extent of coastal erosion and coastline instability	Coastal resilience maintained and improved; and coastal uses made adaptable to coastal erosion
	8.1.2 Changes in sediment dynamics along the coastline	Long term sediment dynamics is within natural patterns
	8.1.4 Length of coastline subject to physical disturbance due to the influence of manmade structures	Physical disturbance to sandy coastal areas induced by human activities should be minimized

- The regional core set of indicators to support climate risk management

Risk management is the process of confronting risks, preparing for them, and coping with their effects. Its goals are twofold: resilience, the ability of people, societies, and countries to recover from negative shocks; and prosperity, derived from successfully managing positive shocks that open opportunities for development. Preparation for risk consists of three actions that can be taken in advance: acquiring knowledge, building protection, and obtaining insurance. Once a risk (or an opportunity) materialises, people take action to cope with what has occurred. A strong risk management strategy would include all four of these components, which interact and reinforce each other (Figure 1).

Figure 1. The interlinked components of risk management



* In order to comply with the topic of this report, Here "Coping" should be understood as "Adaptation".
Source: Risk and Opportunity, Managing Risk for Development, World Development report, main messages, 2014, 4p.

During a meeting that was held at Plan Bleu in November 2014, the following idea emerged: the core set of indicators could be part of developing a wider *"regional early warning system alert"*.

Applied to climate change, risk management could be seen as follows:

The theme of risk transfer mechanisms, through insurance, appears particularly promising and increasingly mentioned in the discussion on adaptation to climate change, especially in relationships with public-private partnership challenges.

This analysis would involve different levels: from territories to the regional and sub-regional levels. The procedures and feasibility of an insurance fund for climate risks at the Mediterranean level, are a particularly promising starting point and have an inclusive scope for the region.

It is important to mention that the inclusion of the topic of insurance mechanisms is not limited to the analysis of its role in reducing vulnerability by compensating losses. This area would also have a major role to play in terms of providing data and information on the risks (linked to MedICIP) but also promoting the incorporation and the development of climate change adaptation strategies (linked with Component II of the ClimVar project).

This aspect is a central issue of promoting adaptation to climate change. It could be a thorough analysis of the integration of climate change adaptation in creating policies and evaluating and implementation projects.

The analytical framework of the *Imagine* method developed by Plan Bleu could provide a useful basis to initiate a participatory process with stakeholders and policy makers.

Moreover, one of the main success factors in developing a *"regional early warning system alert* is the need for a country (or collaboration of countries) to take the lead at the regional level.

I. Background and geographical scope and aims of the core set of indicators

a. Background

The purpose of the respective study is to define of a regional core set of indicators to monitor climate change effects on coastal zones. To do so, a top down and a bottom up approach are to be used.

As far as the bottom up approach is concerned, the national and regional reports produced by participating countries, the CMCC and other consultants in the preparatory stage of the project (2011) are the basis of the study. Moreover, one and a half-day national workshops in each participating country with relevant national experts (involved in monitoring programmes and data collection/analysis/sharing), were held from April to November 2013. These workshops highlighted issues that countries faced as a result of climate variability and change and what their priorities were in terms of adaptation. This report is based on input from countries.

This activity is also linked to the development of the multi-country information sharing platform (MedICIP) and will further specify possible available data and share options according to what is needed for the platform, i.e. data to populate the climate variability and change indicators.

Therefore, the national workshops mentioned above also provided the chance to update and validate national reports, discuss and select the possible available data and institutions in charge of hosting and updating the data.

National experts were given the opportunity to comment on the national climate variability and change issues that were highlighted and make suggestions regarding associated indicators to populate them. Table 9 (in the Appendix) includes recommendations from national workshops.

In addition to the agreed set of indicators, the activity will propose the organisational setting for data collection and information distribution. These indicators will build upon indicators from MSSD, EEA, Plan Bleu experience, UNSDSN and to a lesser extent from SEIS, MSFD, EcAP, SWIM/Water Directive. MEDCOF was also an interesting basis. The use of these references constitutes the top down approach.

b. Geographical scope and aims of the core set of indicators

The geographical unit considered for this study is the coastal region for certain indicators and watershed basin for others. As far as the coastal region is concerned, the definition provided by the ICZM protocol of the Barcelona Convention is the guide. The proposed core set of indicators is defined for the regional level (Mediterranean basin) and each indicator could be calculated at the national level. The main objective of the core indicators is to monitor the climate variability and change adaptation policies while taking into account specific national coastal challenges.

The initial core set of indicators should focus and could be structured according to the four groups below.

II. National experiences in countries related to Climate Change and Indicators

This section highlights national experiences regarding CVC and ICZM indicators and presents comments on the proposed core indicators made by Montenegro (Table 3), Egypt (Table 4), and Algeria (Table 5).

a. Montenegro

Table 2. National experience of Montenegro: monitoring programme, database and registered CVC and impacts

Monitoring programmes	Website address
IHMS collects hydrological, meteorological, oceanographic, air quality and water quality data	www.hmz.gov.me
DMCSEE bulletin, maps of SPI index and precipitation	DMCSEE
Projected vulnerability using climate models for the period 2001-2030,2071-2100	http://www.unfccc.me

Table 3. Comments about the core set of indicators for Montenegro

Issue	Comments
Water	• No measurements of flow on the Bojana river WATER, but data on water level is available (Albanian colleagues have Bojana River flow data) • The Moraca River flows indirectly into the Adriatic Sea. For this river there is data that can be used to calculate the proposed indicators. • Suggested indicators are acceptable but have yet to be calculated • Flow data for specific springs and data on salinity (e.g. in Kotor and Tivat). Data belong to water supply systems in the municipality but IHMS is able to get it from them.
Sea	• Sea acidification (pH) in general is done by depths and on the surface. • According to the measurements it is mostly above 8. • Trend analysis has yet to be carried out. • Useful to have a manual of pH calculation procedures due to CO_2 emissions in order to check feasibility base on weather in our case
Land	• Loss of arable land - statistical data vary from one data source to another • Analysis of attractiveness within CAMP project shows that the total surface of attractive arable land is around 44.600 ha, while 21.187 ha of it is suitable for olives, citrus, and vines. • The quality of the land is monitored on several hot spots with respect to the pollutants (5th report of National Strategy of Sustainable Development • EROSION – to assess status (terrestrial and seaside erosion), collect the data, define indicators, upgrade the current National Institutional setup, enforce implementation of LULUCF (e.g. land degradation, land use change, etc.)
Climate extremes and GHG emissions	• Indicators of extremes are calculated according to the WMO/CLIVAR • SPI,FVC and LAI are calculated for drought monitoring (FVC and LAI with assistance of DMCSEE) • For GHG emissions data – available tables, graphs and reports • Concentration of Pb and PAH in the capital city of Podgorica still below the boundary value
Coastal zone	• To extend the marine ecosystem monitoring programme to territorial water and to apply relevant ECAP indicators • To improve the dataset and indicators for coastal biodiversity
Protected areas	• 9.04% of the total territory of Montenegro is protected – most of it in National parks (7.77%), others as cultural heritage sites, areas of specific natural characteristics and reserves • 8.6% of the total coastal region surface is protected and 0% for the sea (estimated surface of potentially valuable areas is 18.8% on the land with respect to the surface of the coastal zone, and approximately 9000 ha in sea surface)
Socioeconomic movement and tourism	• The population growth rate in the coastal area and population density is calculated • Tourism – the annual number of nights during and after the season is calculated

b. Egypt

Egypt's large population and high population density make the country extremely vulnerable to climate change impacts. Moreover, the presentation of the country profile indicated that the following areas are the most vulnerable in order of severity and certainty of results:

- coastal zones
- agriculture
- aqua-culture and fisheries
- water resources
- human habitat and settlements
- human health

Projections of SLR and expected impacts on the Coastal Zones are one of the most important considerations so far. As a result of the SLR, there is likely to be a migration of at least two million people from the Delta coastal areas due to flooding and loss of fertile land.

The following three mentioned issues are the most important in Egypt:

1. As far as "Sea Level Rise" is concerned:
   - Second country due to the significant impacts of SLR on 10% of its population with 1m SLR.
   - Third country for the impacts on its GDP which will lose more than 6 % with 1m SLR.
   - Fifth country in the impacts of urban sprawl.
2. As far as "Land use / agriculture" is concerned:
   - Egypt occupies the top rank of impacts on agriculture sector. More than 16% of its agriculture is threatened with 1m SLR while more than 30 % of its population depends on it for their income
3. As far as "Populations at risk" is concerned:
   - As a result of SLR, there is likely to be migration of at least two million people from the Delta coastal areas due to flooding and loss of fertile land. This migration will have impact on human habitats and settlements.

In the discussion of indicators, the following recommendations received particular emphasis:

First of all, it is necessary to emphasize the need for EEAA capacity building and the establishment of institutional capability for monitoring, assessment and follow up. In particular, the Governance category requires more quantification of indicators.

The Governance category indicators should therefore have specific quantification guidelines

Third, it is necessary to establish guidelines for monitoring each and every indicator and make it available for regional dialogue and discussions

Finally, expanding some indicators such as:

- Storms to include severity, frequency and duration
- Marine and coastal indicators to include land use vulnerability index and coastal risk of exposure to hazards
- Terrestrial coastal ecosystems to include sensitive and protected areas

Table 4. Comments about the core set of indicators and possible data providers

Field	Issue summary	Indicators	Source of data / data providers (by country/international)
Water	Changes in seasonal river flows	Number of days with low-water flows	Egypt Second National Communication
Land	Protected areas	Effective management of protected areas (Surface, Number, %)	Egypt Fifth National Biodiversity Report (CBD) Convention
Sea & coast	Sea acidification	pH	National Program for Coastal Water Monitoring
Health	Diseases (incidents) related to climate change	Mortality due to heat waves	*NA*
Governance	Local development plans integrating CC	Existing local plans integrating CC adaption measures(budget)	The national adaptation strategy was adopted by the cabinet of the ministries in 2011
Climate	Extreme events by type (drought, flash floods, strong winds, heat waves)	Number of extreme events by type per year.	*NA*
	Increase of GHG emissions	GHG emissions (local level)	Egypt Second National Communication
		% of GHG emissions per sectors (national level)	The final records according to IPCC reports and UNFCCC COP decision amendments
Biodiversity	Threatened species	Number of threatened species	Egypt Fifth National Biodiversity Report (CBD) Convention
	Effect of water temperature increase on marine Biodiversity	Sea surface temperature	National Program for Coastal Water Monitoring
Population and urbanisation	Population growth in coastal areas	Population growth in coastal areas	CAPMAS
		Population density in coastal areas	CAPMAS
Coastal	Shoreline protection	Percentage of the coast with protection	Egypt Second National Communication
	Zones potentially affected by floods	Area of coastal zone flooded (%)	Egypt Second National Communication
	Protected areas	Percentage of coastal and marine protected areas effectively managed (%)	Egypt Fifth National Biodiversity Report (CBD) Convention
	Sea level rise	Percentage of land exposed to sea level rise (percentage of the exposed urban zones)	Egypt Second National Communication
		Sea level rise	Egypt Second National Communication

c. Algeria

In Algeria, some environmental and sustainable indicators are available. Algeria is actively involved in efforts in the field of sustainable development at the international level, in formulating political sustainable development issues as part of a national strategy, including monitoring and evaluation based on a set of indicators to assess the progress made in terms of objectives and thus assist in creating policies.

Table 5 shows a list of indicators directly related to the subject of this report. This table has two subsets entitled “Available indicators” and " indicators available in the medium and long term”.

This classification takes into account the availability of data and the stage of development of calculation. In other words, the work on certain areas, such as "Population growth" or "purification

rate of wastewater" have been studied for a longer period, therefore, calculating these indicators is feasible in the short-term. They are thus classified in the sub-set as 'available indicators'.

However in other areas such as "Endangered Species", work is at a very preliminary stage, or even non-existent. Calculating these indicators requires a relatively long time for the production of all of the data, to collect it and, ultimately, process it, which is why these indicators have been classified in the subset as “medium- and long-term indicators”.

Table 5. Some environmental and sustainable development indicators

Theme	Available Indicators	Indicators available in the medium and long term
Overall preservation of the Environment	Changes in energy consumption	GHG emissions
	Quality of surface water	GHG emissions due to road traffic
	Quality of bathing water	Import of ozone depleting substances
	Water withdrawal by sector	Electricity generation from renewable energy sources
	Purification rate of wastewater	Amount of household waste collected per capita
	Tax rate of groundwater	Hazardous waste
	Artificial farmland	Endangered species
	Forest fires	Soil erosion
	Coastal development	Coastal erosion
	Fishery resource intensity	
Sustainable societal development	Population growth	
Sustainable economic growth	PIB per capita	
	Environmental management spending	
	Utilised farmland/ total farmland	
	irrigated farmland / Utilised farmland	
	Undeveloped / Utilised farmland	

Source: ONEDD 2010.

As far as the availability and exchange of environmental information is concerned, the National Observatory of Environment and Sustainable Development (ONEDD) has developed an Environmental Information System.

ONEDD collects, stores, processes and interprets environmental data, develops and disseminates the information tool and provides decision-making support. It also creates and promotes the government’s environmental monitoring and assessment systems and mechanisms.

Finally, in 2010, the ONEDD launched a project to develop the global environmental information system (EMIS). It is supplied by all data produced by the Observatory and / or collected from data producing agencies (environmental and socioeconomic) and is based on GIS technology.

The National Statistics Office (NSO) is part of the interagency committee on environmental and sustainable development indicators launched by ONEDD. The experience of the NSO in the field of the environment was initiated as part of the environmental programme under the MEDSTAT project.

The NSO publishes a statistical yearbook whose most recent 2009 edition includes an Environment section, compiling water resource data (quality, dams and boreholes), and a description of the coast and forests.

Finally, Algeria’s experience should not go without mentioning an initiative dealing with climate change indicators, the CIRCE project.

CIRCE aims to develop, for the first time, an assessment of climate change impacts in the Mediterranean area.

The objectives of the project are:

- to predict and to quantify physical impacts of climate change in the Mediterranean area;
- to evaluate the consequences of climate change for society and the economy of populations located in the Mediterranean area;
- to develop an integrated approach to understand the combined effects of climate change;
- to identify adaptation and mitigation strategies in collaboration with regional stakeholders.

CIRCE wants to understand and explain how climate will change in the Mediterranean area. The project investigates how global and Mediterranean climates interact, how the radiative properties of the atmosphere and radiative fluxes vary, the interaction between cloudiness and aerosol, changes to the water cycle. Recent observed changes to climate variables and detected trends are compared. The economic and social consequences of climate change will be evaluated by analysing direct impacts on migration, tourism and energy markets along with indirect impacts on the economic system. CIRCE will also investigate the consequences on agriculture, forests and ecosystems, human health and air quality. The variability of extreme events in the future scenario and their impacts are assessed. A rigorous common framework, including a set of quantitative indicators developed specifically for the Mediterranean environment will be developed and used in collaboration with regional stakeholders. The results should be incorporated in a decision support system tool and disseminated to the relevant users. Possible adaptation and mitigation strategies will be identified.

For the purposes of and within the framework of this project, ecological vulnerability indicators, coastal vulnerability indicators and information sheets have been developed.

d. Tunisia

The Tunisian Observatory for Environment and Sustainable Development (OTEDD) under the authority of the Ministry of the Environment and Sustainable Development is considered as the dashboard that monitors the activities of sustainable development and indicators in the country. Its aim is to establish permanent collection, production, analysis, management and dissemination of information concerning the state of the environment and sustainable development, in order to help decision-makers, while taking into account the requirements of environmental protection and development.

Some initiatives dealing with climate change and ICZM exist at the national level. In Tunisia, the National Sustainable Development Strategy was completed in 2014. The Strategy had identified 9 challenges (challenge number 7 concerns adaptation to climate change) and some indicators had been identified by OTEDD to evaluate the implementation of the challenges.

OTEDD developed an indicator to measure the vulnerability of the Tunisian coast. The expert stressed that there is a cost to calculating an indicator and it needs to be updated so there is a need for resources (human and financial).

Presentations done by country representatives first confirmed that issues identified during national workshops in 2013 are still the same but the same level of priority is not shared in each country. A high level of experience was presented by countries and showed that data and indicators already exist at the national level but the need for a regional core set of indicators was emphasized.

Some reports on sustainable development indicators are available on the OTEDD's website.

Tunisia has developed a coastal climate change national adaptation strategy that is monitored by the Coastal Observatory under the supervision of the Coastal Protection and Planning Agency (APAL).

III. Methodology

The first main task consisted of organising issues highlighted by experts during national workshops. A table with common issues between countries was produced.

Dialogue built on the national reports prepared during the project preparation phase, mainly focused on climate data and monitoring programmes on in order to provide input for the development of a platform, under another activity. But this work was also useful in determining how and where to find data to populate indicators. Finally, during these workshops, invited experts also had the opportunity to express the main issues their countries are facing as a result of climate variability and change impacts and their current experience with climate change indicators.

a. Identification and definition of common issues

This section is dedicated to the description of each common issue shared by the countries. The proposed definition focuses on what is expected to be followed through the core set of indicators presented later in the document.

Field	Issue summary	Issue description
WATER	Changes in seasonal river flow	Here the potential impacts affecting changes to river flow during the year and especially decreasing water flow are measured. Water flow maintains life in ecosystems, and supplies water for human needs (agriculture, industry, homes, etc.) but may be altered due to climate change. Decreased precipitation and reduced average flow rates are expected in many Southern and Eastern Mediterranean countries. These changes will have a particularly significant impact on water security in these countries. *Source: "Les Cahiers du Plan Bleu", September 2010*
	Quantity and quality of groundwater resources	This highlights concerns related to groundwater, especially levels and the potential presence of salt as a consequence of climate change. These two elements are crucial to consider because they have consequences on local water supplies. Moreover, as a result of climate change, the significant decrease in rainfall observed during the last thirty years has significantly reduced dam reservoir levels, therefore resulting in overuse of groundwater. *Source: IDDRI, 2009.* Groundwater resources in the Mediterranean region are threatened by various development activities and mismanagement. Groundwater has been overexploited through excessive, uncontrolled pumping in many groundwater basins, and groundwater quality is deteriorating as a result of seawater intrusion into coastal aquifers. In addition to their overexploitation and seawater intrusion, groundwater resources are being threatened and polluted by numerous point and non-point sources of pollution generated from anthropogenic sources (agricultural, industrial, and urbanization activities). Three main indicators can be used to monitor: a) decline in water levels, b) deterioration of water quality and c) land subsidence. *Source: UNESCO, 2005.*
	Quality of coastal water	This issue means safeguarding public health and protecting the aquatic environment in coastal and inland areas from pollution due to the increase in anthropogenic pressure on ecosystems and the associated water quality decline. The northern region of the Mediterranean basin is covered by European bathing water legislation (the 'Bathing Water Directive). Bathing water covered by the Bathing Water Directive can be coastal water or inland water (rivers, natural lakes, reservoirs and ponds) in which bathing is explicitly authorised by the competent authorities of each Member State, or not prohibited and traditionally practiced by a large number of bathers. The period during which bathers can be expected in bathing areas depends largely on local bathing rules and weather conditions. Bathing seasons can also vary within Member States. *Source: European Environmental Agency, Bathing water quality (CSI 022/WAT 004) - Assessment published Oct 2012*

	Quantity and quality of groundwater resources	More than a quarter of the approximately 600 billion m^3 of water received annually in the Mediterranean Basin takes subterranean routes in parts of its path. Aquifers also contain the major part of the Mediterranean Basin's water reserves, and these reserves account for the largest part, perhaps even the whole, of the summer flow of the Basin's rivers and other streams. A panoramic overview, focussing on the Mediterranean Basin, highlights both the general importance of the quantity and quality of groundwater as a vital resource for the Mediterranean people and for the natural environment, and also the diversity of the groundwater available and its utilisation. Transboundary groundwater resources are increasing in importance. As much as 80% of the water resources in the Mediterranean region is shared between two or more countries. *Source: http://www.academia.edu*

Field	Issue summary	Issue description
LAND	Soil degradation	Until the early seventies land degradation and desertification were not considered a major issue in most Mediterranean regions. Traditional agricultural systems were believed to be able to keep those processes in check. Thus low priority was assigned to research programmes and projects on soil erosion and conservation. Climate change impacts might increase soil degradation. Moreover the degradation of soil affects other issues such as local and diffused contamination, acidification, eutrophisation and physical deterioration. *Source: "Climate change, land degradation, and desertification in the Mediterranean environment", 2006*
	Land use / land cover changes	Land-use/land-cover change is the most important factor in causing biodiversity loss. The Mediterranean region has been affected by entropic disturbance for thousands of years, and is, nowadays, one of the most significantly altered hotspots in the world. Land-use/land-cover changes and the associated habitat loss are a consequence of natural and human driven processes and many studies indicate high rates of change since the 1970s associated with high human population growth rates, land-use intensification, and loss of natural habitat. The Mediterranean basin, one of the four most significantly altered hotspots on Earth, has been intensively affected by human populations for thousands of years especially along the coasts, significantly longer than any other hotspot. *Source: Changes in land-use/land-cover patterns in Italy and their implications for biodiversity conservation, 2006.*
	Forest fires and droughts	With an average of 50,000 fires and 600,000 ha burnt, forest fires in the Mediterranean basin represent a significant part of all fires that occur in the world. Several sources estimate the total annual cost of fire fighting and safety devices in the region to be more than US$1 billion (Le Houérou, 1987). Despite the efforts made, particularly in the countries of southern Europe, the phenomenon is not stabilizing and even appears to be increasing significantly even if it is not easy to form an accurate picture of the overall increase. Climatic phenomena such as decreasing rainfall and dry storms might increase the risk. *Source: FAO, Mediterranean forests, 1999.*

	Soil erosion and deficiency	Mediterranean areas are characterized by the alternation of a humid-cool and a hot-dry season. Consequently, soils are generally fragile, because of exposure to heavy storms, drought periods, high temperatures, low plant cover, and, often, steep slopes. In addition, the Mediterranean basin shows a history of intense use and management of soils for millennia, which has led to severe erosion and desertification processes. In many parts of Mediterranean areas, soil erosion processes have reached an irreversible stage due to human-induced degradation. Some of the causes of soil erosion in Mediterranean areas are inappropriate agricultural management, deforestation, agriculture and land use changes. The identification of causes of soil erosion processes (land use change, land abandonment, conflicts, migrations and demographic pressure, land use policy, etc.), is crucial to keep soil erosion under control whenever possible. *Source: European Geosciences Union General Assembly 2014, Soil erosion and desertification processes in Mediterranean areas.*

Field	Issue summary	Issue description
CLIMATE	Extreme events by type *(drought, flash floods, strong winds, heat waves, storm surges)*	The Mediterranean is one of the regions likely to be most rapidly confronted with major physical difficulties connected with climate variability and extreme events. A possible description of extreme processes is both a change in intensity and frequency of events (drought, flash floods, strong winds, heat waves). The adverse impacts of extreme events would significantly affect growth in the region and create major difficulties in the countries. *Source: Plan Bleu, Evaluation of the Economic Impacts of Extreme Event in Mediterranean Countries, 2010.*
	Increase of GHG emissions	Climate changes are extremely complex and related to the concentration of greenhouse gases in the atmosphere. Most greenhouse gas emissions are due to the consumption of fossil fuels for energy production. On the other hand, there is an obvious link between climate change and energy demand. Although the impacts of greenhouse gas build-up remain uncertain, they have the potential to be very serious and possibly catastrophic in the Mediterranean region. This issue focuses on the impact of climate change from the emission of greenhouse gases, especially CO2. The aim is to confront climate change and develop sustainable energy systems with low CO2 emissions. *Source: 1st EMUNI Research Souk 2009 (EMUNI ReS 2009), the Euro-Mediterranean Student Research Multi-conference, Unity and Diversity of Euro-Mediterranean Identities, 9 June 2009.*

Field	Issue summary	Issue description
HEALTH	Diseases (incidents) related to climate change.	The combination of heat and pollution would lead to an upsurge in respiratory illness among urban populations, while extreme weather events could increase death and injury rates. Water shortages and damaged infrastructure would increase the risk of cholera and dysentery. Higher temperatures would increase the incidence and extent of infectious diseases, such as malaria, dengue fever, schistosmaisis and yellow fever. *Source: Gillet, 1974; WH0, 1990.* Higher temperatures could also cause a proliferation of insect pests as warmer and longer growing seasons provide time for pests to reproduce more often. *Source: Pimentel and Pimentel, 1978.*

Field	Issue summary	Issue description
BIODIVERSITY	Invasive species	The monitoring of the spreading of invasive species is crucial in Mediterranean coastal zones. Indeed, climate change might create favourable conditions for the proliferation of non-indigenous and invasive species, particularly those with warm-water affinities. For example, the regression of certain meadows may give a competitive advantage to other species. *Source: UICN and MedPan, 2012*
	Threatened species	Mediterranean climates are characterized by hot, dry summers and mild, wet winters. These regions cover only 2.2 percent of Earth's land surface, yet they account for 20 percent of all known plant species. Between 60 and 80% of current species are projected not to persist in the southern European Mediterranean region if the global mean temperature increases 1.8°C. *Source: Physical Sciences department, New York, 2010.*
	Effect of water temperature increase on marine biodiversity	The warming of the western and eastern Mediterranean Sea will continue to dominate throughout the 21st Century with a sea surface temperature increase of 2.5-3°C expected by the end of this century. Warming of both the Mediterranean Sea's surface and deep waters is likely to be accompanied by increases in salt content. The main impacts of this on biodiversity are high local extinction intensity along the southern coast of the Mediterranean while many species invade the Ligurian and Adriatic Seas in the north. *Source: Climate change and impacts in the Eastern Mediterranean and the Middle East, The Cyprus Institute.*
	Protected areas	Marine protected areas in the Mediterranean (MPA) cover about 4% of the Mediterranean. Some MPA have an insufficient number of personnel or equipment, indicating a low capacity and potential for management. However, the northern Mediterranean MPAs are very heterogeneous. Many of them have excellent management and can be considered as benchmarks for MPA. Mediterranean MPAs are affected by multiple anthropogenic threats from adjacent or close by land and marine areas which may influence their effectiveness. More than half of the MPAs are affected by anchorage, invasive plants, over fishing, noise pollution, solid waste, the degassing of oil and diesel or oil spills, changes in plant composition or animals due to climate change as well as urbanization or artificial constructions. *Source: MedPan & RAC SPA,The Status of Marine Protected Areas in the Mediterranean Sea, 2012.*

Field	Issue summary	Issue description
GOVERNANCE	National and local development plans/strategies integrating CC	Through the preparation of action plans for the adaptation to climate change and the production of vulnerability maps, it is possible to provide city governments useful tools for the integration of climate change issues in planning documents and for the development of sustainable policies (urban, fishing, tourism, etc.) thus strengthening the resilience of communities. *Source: Mediterranean Canter for Integration - Marseilles, 2013.*
	Level of mainstreaming CC adaptation in the implementation of national policies	Existing Mediterranean strategies and European directives allow central bodies of Mediterranean countries to draft policies which integrate climate change adaptation at the national level. The idea here is to follow the level of CC adaptation in national policies. *Source: Plan Bleu, 2014.*
	Risk Management	Risk management is the process of confronting risks, preparing for them, and coping with their effects. Its goals are twofold: resilience, the ability of people, societies, and countries to recover from negative shocks; and prosperity, derived from successfully managing positive shocks that open opportunities for development. Preparation for risk consists of three actions that can be taken in advance: acquiring knowledge, building protection, and obtaining insurance. Once a risk (or an opportunity) materializes, people take action to cope with what has occurred. *Source: Risk and Opportunity, Managing Risk for Development, World Development report, main messages, 2014, 4p.*

Field	Issue summary	Issue description
POPULATION & URBANIZATION	Population growth in coastal areas	Approximately 145 million people – around 35% of the total Mediterranean population– currently make up the population of the Mediterranean coast. The Mediterranean is also the most popular tourist destination with 170 million people visiting each year. Coastal areas and natural resources are facing severe pressures from over-crowding and unrestrained development. *Source: UNEP MAP, 2010.*
	Populations at risk	One of the major concerns of the global warming is the impact on human health. Climate change affects human health via pathways of varying complexity, scale and directness and with different timing. Similarly, impacts (both positive and negative) vary geographically as a function of the physical and environmental conditions and of the vulnerability of the local human population. To date, there is significant evidence that the Mediterranean Basin is already experiencing some of the early impacts of climate change. The main phenomena are temperature increase (especially during the summer months), an enhanced frequency and the intensity of heat waves, a reduction in the total precipitation amounts along with increasing rainfall intensity and enhanced drought. In addition, the Mediterranean area has to deal with growing population pressure. All of the above issues increase the population's vulnerability to possible impacts of climate change on human security, such as sea level rise, reduced water availability, increased salinity and eutrophication of coastal waters, crop yields vulnerability as well as direct impacts on human health – heat waves, wildfires, vector-borne diseases, air pollution, etc. *Source: Workshop "Impacts of Mediterranean Climate Change on Human Health, Energy, Environment and Water Research Center", the Cyprus Institute, Paphos, Cyprus, 19-21 October 2009, 10 p. - http://www.medclivar.eu/Science_meeting_reports_FinalReport2488.pdf*

Field	Issue summary	Issue description
SEA & COAST	Shoreline protection	Coastal erosion necessitates very expensive shore protection schemes. Moreover, the presence of coastal defence structures is almost always accompanied with accelerated downcoast erosion. Therefore, coastal defence structures do not stop beach erosion, but transfer this problem to another location downcoast. A solution could be firstly to gain a better understanding of the future evolution of the shoreline, and secondly by following a coastal policy to accommodate the erosion-prone areas as "no development" buffer zones in coastal land use plans. The key point here is the acceptance of the fact that several segments of the Mediterranean coast will erode as the consequence of anthropogenic activities which have already taken place at inland locations (building of dams, river diversions, water consumption, etc.). The erosion process will continue until new equilibrium shapes the shoreline and the nearshore topography is formed under reduced (or completely stopped) sedimentation. In the legislation of the Mediterranean countries, there is usually a minimum width of the shore band where construction is restricted. This width (usually 100 meters) is not wide enough for a location that undergoes significant erosion. *Source: PAP RAC, Coastal erosion management in the Mediterranean, 2002.*
	Sea level rise	The position and height of the sea relative to the land (relative sea level - RSL) determines the location of the shoreline. Although global fluctuations in sea level may result from the growth and melting of continental glaciers and large-scale changes in the configuration of continental margins and ocean floors, there are many regional processes that result in the rise or fall of RSL that affect one coastline and not another. The most vulnerable zones in the Mediterranean are sandy beaches, river deltas and lagoon areas. *Source: Plan Bleu, 2013.*
	Zones potentially affected by floods	Different types of floods affect Mediterranean countries - flash floods, river floods, coastal floods. The main reasons for the increasing vulnerability to floods: uncontrolled urban sprawl on flood prone areas, construction on slopes, deforestation and land use changes which reduced the soil water retention capacity and increase the run-off rate in case of heavy rains. In addition to these reasons climate change is a new parameter to consider. According to the EMDAT Disaster Database, floods remain the most common natural disaster in the Mediterranean. In the period 1990-2010, floods accounted for 35% of all natural disasters that hit the Mediterranean region. Some 210 destructive flood events struck the 22 countries during the past 20 years affecting 3,220,000 people, causing 4,250 deaths, and economic losses totalling €25,000 billion. *Source: international disaster database, 2012.*
	Zones potentially affected by storm surges	Mediterranean storms induce flash floods caused by excessive amounts of rainfall within a short lasting period of time. The intensity and duration of precipitation, region geomorphology, urbanization and different governmental emergency management structures trigger different consequences between Mediterranean countries. The human settlement and investment in high risk floodplains place greater numbers of people and economic assets in danger of being affected by storms and floods. Disasters and development are highly inter-related. Recurrent disasters and frequent localized disasters erode development and conversely the development processes can reduce disaster risk, or create new risks. *Source: Mediterranean Storms: An Integrated Approach of Risk Management, 2014.*

	Coastal erosion	Whether it is due to natural or anthropogenic reasons, coastal erosion causes significant economic losses, social problems, and ecological damage. Coastal erosion is defined as the long-term loss of shore material (volume) relative to a fixed reference line (baseline) and initial reference volume seaward of this line above some arbitrary vertical datum (Basco, 1999). In the Mediterranean, coastal erosion has been a longstanding, large-scale issue around the deltaic areas, such as the deltas of the Nile and Po Rivers, and the smaller deltas like those of the Albanian rivers. It has also been a major issue on smaller scales, especially in the municipal or tourist resort beaches along the relatively more densely developed northern coast, following the flux of people from inland areas to the coast and the boom of the tourism industry. *Source: PAP RAC, Coastal erosion management in the Mediterranean, 2002.*
	Sea acidification	Ocean acidification appears as another environmental pressure associated with anthropogenic emissions of carbon dioxide, on Mediterranean Sea ecosystems, already suffering from overfishing, increasing sea surface temperatures, and invasions of alien species. The efficiency of carbon uptake and export from the surface waters to the basin interior depends on the relatively rapid time scales for surface-to-deep water exchange and the Mediterranean general circulation. Thus the combined effect of Mediterranean seawater acidification (absorbing anthropogenic CO2 per unit area), with low tropospheric warming on Mediterranean biogeochemistry, ecosystems, through direct impacts on its highly adapted calcareous and non-calcareous organisms, may be larger than in other European regions. *Source : MedSea, CE-FP7, 2013*

Field	Issue summary	Issue description
TOURISM	Extension of the tourist season	Tourism is a key economic activity for the Mediterranean region that generates growth and employment. In recent years, the strategy has not only been to promote the central tourist destinations but also the surrounding areas, to extend the tourist season, to reduce tourism concentration, and enhance environmental and economic sustainability. *Source: The South East Europe Transnational Cooperation Programme, 2014.*

b. Issues' level of importance by country

Issues \ Mediterranean regions		*Morocco, Algeria, Tunisia*	*Croatia, Bosnia and Herzegovina, Montenegro, Albania*	*Egypt, Palestine, Libya, Syria*
WATER	Changes in seasonal river flow	**HP (3/3)**	**HP (3/4)**	**HP (2/2)**
	Quantity and quality of groundwater resources	**HP (3/3)**	**HP (3/4)**	**HP (2/2)**
	Quality of coastal water	**LP (1/3)**	**MP (2/4)**	**MP (1/2)**
LAND	Soil degradation	**HP (3/3)**	**MP (2/4)**	**HP (2/2)**
	Land use / land cover changes	**LP (1/3)**	**MP (2/4)**	**HP (2/2)**
	Forest fires and droughts	**MP (2/3)**	**MP (2/4)**	**HP (2/2)**
	Soil erosion and deficiency	**HP (3/3)**	**MP (2/4)**	**MP (1/2)**
CLIMATE	Extreme events by type (drought, flash floods, strong winds, heat waves, storm surges)	**HP (3/3)**	**MP (2/4)**	**HP (2/2)**
	Increase of GHG emissions	**HP (3/3)**	**MP (2/4)**	**LP (0/2)**
HEALTH	Diseases (incidents) related to climate change	**MP (2/3)**	**LP (1/4)**	**HP (2/2)**
BIODIVERSITY	Invasive species	**MP (2/3)**	**MP (2/4)**	**MP (1/2)**
	Threatened species	**HP (3/3)**	**MP (2/4)**	**MP (1/2)**
	Effect of water temperature increase on marine biodiversity	**LP (1/3)**	**MP (2/4)**	**HP (2/2)**
	Protected areas	**HP (3/3)**	**LP (1/4)**	**MP (1/2)**
GOVERNANCE	National and local development plans/strategies integrating CC	**HP (3/3)**	**MP (2/4)**	**HP (2/2)**
	Level of mainstreaming CC adaptation in the implementation of national policies	**HP (3/3)**	**HP (3/4)**	**HP (2/2)**
	Risk Management *(mentioned after the workshop)*			
POPULATION & URBANIZATION	Population growth in coastal areas	**HP (3/3)**	**HP (3/4)**	**HP (2/2)**
	Populations at risk	**HP (3/3)**	**HP (3/4)**	**HP (2/2)**
COASTAL	Shoreline protection	**HP (3/3)**	**MP (2/4)**	**MP (1/2)**
	Zones potentially affected by floods	**MP (2/3)**	**MP (2/4)**	**MP (1/2)**
	Zones potentially affected by storm surges	**MP (2/3)**	**MP (2/4)**	**HP (2/2)**
	Coastal erosion	**HP (3/3)**	**MP (2/4)**	**HP (2/2)**
	Sea level rise	**HP (3/3)**	**HP (3/4)**	**HP (2/2)**
	Sea acidification	**LP (1/3)**	**MP (2/4)**	**MP (1/2)**
TOURISM	Extension of the tourist season	**LP (1/3)**	**LP (1/4)**	**MP (1/2)**

Legend: HP: High priority - MP: Medium priority - LP: Low Priority

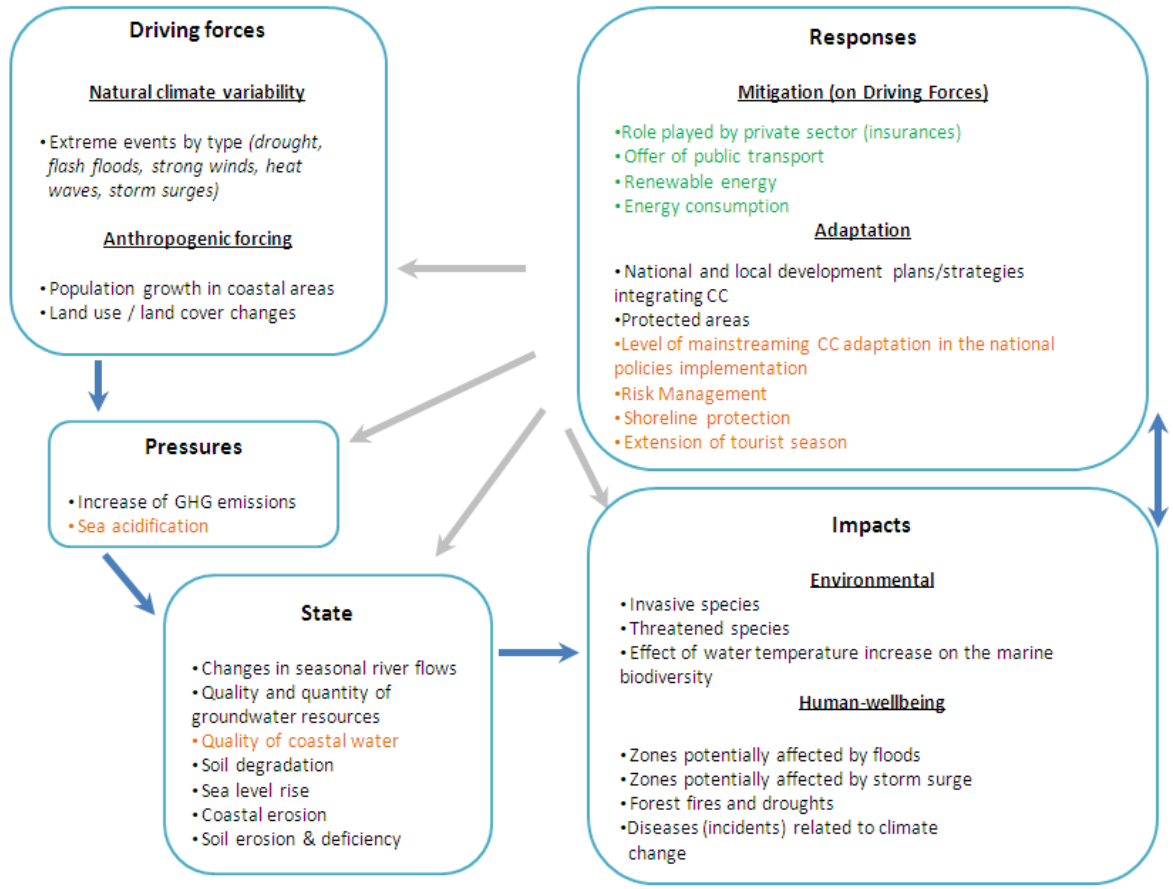
c. Distribution and ranking of each issue using the DPSIR framework

This report uses the driving forces-pressures-state-impacts-responses (DPSIR) framework to explore the effects of CVC on coastal zones and to organise the relationship between common issues. The DPSIR framework was developed by the European Environmental Agency to improve the socioeconomic and sociocultural aspects of environmental reporting.

The DPSIR model is an expansion of the pressure-state-response (PSR) framework, also known as the pressure-condition-response (PCR) model, which was developed by the Organization for Economic Cooperation and Development (OECD). The DPSIR model extends the PSR/PCR framework by taking into account the driving forces or causes for change as well as the impacts on environmental, social and economic systems. This framework was initially designed to deal with the "environment" field so "social aspects" are not directly treated. But these aspects are considered in the "I" (standing for impacts).

There is fairly substantial literature on the benefits and limitations of the DPSIR approach. The question seems to be well summarized by the abstract of the paper by Maxim et al (2009): *"the Driving Forces–Pressures–State–Impacts–Responses (DPSIR) framework is a relevant tool for structuring communication between scientists and end-users of environmental information, while it is inappropriate as an analytical tool. An apparently deterministic, causal, description of environmental issues inevitably downplays the uncertainty and multiple dimensions of causality inherent in complex environmental and socio-economic systems".*

Figure 2. The countries common issues are organised using the DPSIR framework



Legend
Black: common issues between countries, from discussions during national workshops (April to November 2013)
Green: specific issue mentioned by only one country
Orange: Expert proposals regarding crucial but non-mentioned issues.

d. Selection of indicators using the RACER methodology

The next main task was to select indicators using the RACER methodology.

It should first be noted that an indicator must be:

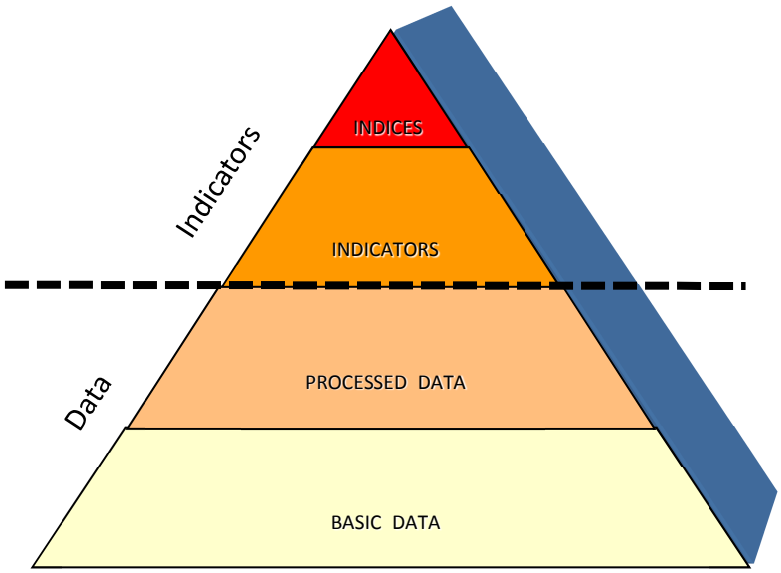
- Conceptually well founded.
- Understandable (clear, simple and unambiguous).
- Based on data that are readily available or available at a reasonable cost, adequately documented, of good quality and updated at regular intervals.
- Within the capacities of the governments to implement, given logistics, time, technical and other constraints.

A method exists which proposes criteria for the selection of an indicator, adapted from the United Nations Commission on Sustainable Development (CSD). Thus, the choice was made to work using the RACER method. The RACER method is an acronym which stands for: Relevant, Accepted, Credible, Easy and Robust. This method is an evaluation framework revised in 2008 and applied to assess the value of scientific tools for use in policy making. It was developed within the framework of a DG ENV project "Potential of the Ecological Footprint for monitoring environmental impacts from natural resource use." Moreover, the European Commission specified in its publication "Impact Assessment Guidelines" (European Commission, 2005) that indicators should fulfil the so-called RACER method.

The RACER method interested experts invited to the workshop held at Plan Bleu in November 2014[3] but the method is complex and quite difficult to apply in the short working sessions. For instance, there are a lot of variations between countries regarding the ranking system for each indicator. During the workshop, it was possible to start fulfilling the 19 RACER sub-criteria for each indicator of the preliminary list. This work will need to be continued and confirmed by the experts after the workshop and consultation could be extended to a wider audience (through questionnaires). It is also possible to fulfil just the 5 RACER criteria, keeping in mind the 19 sub-criteria.

A Plan Bleu expert explained that it is necessary to distinguish between data / processed data / indicator / index. He also stressed that data can exist but it does not mean that it is available. It therefore does not mean that data is accessible. The information pyramid was presented to illustrate the purpose.

Figure 3. The information pyramid



[3] Workshop on the presentation and validation of a regional core set of indicators on climate variability and change and ICZM. Friday 21th November 2014 – Plan Bleu's premises, Sophia-Antipolis, Valbonne, France

e. Finally, for each issue, 1 to 7 indicators were assigned and ranked

Theme	Number of indicators selected
Water	4
Land	7
Climate	3
Health	1
Biodiversity	5
Governance	4
Urbanisation & population	3
Sea & Coast	7
Tourism	1

IV. The proposed core set of indicators

The core set of indicators related to the ICZM protocol and existing data sources

Field	Issue summary	Indicator title	Policy objectives from ICZM protocol	Data source / data providers / examples (international)
WATER	**Changes in seasonal river flow**	**Number of days with low-water flow**	Article 9 Economic Activities, e , (iii)	Example in UK : http://www.ecn.ac.uk/iccuk/indicators/7.htm See example for EEA member countries: • http://www.eea.europa.eu/data-and-maps • http://www.eea.europa.eu/data-and-maps/indicators
	Quantity and quality of groundwater resources	**Overexploitation of groundwater**		Plan Bleu
		Irrigation water requirement		Plan Bleu
	Quality of coastal water	**Salinity in coastal aquifers**		Example in France: http://www.onema.fr/IMG/EV/EV/plus/AquifereUKpp.pdf
LAND	**Soil degradation**	**Rate of land abandonment**	Article 9 Economic Activities, 2, (a)	FAO : http://www.fao.org/nr/land/use/en/ For the national level: http://faostat.fao.org/ ESA Globcorine : http://pegasosdi.uab.es/viewer/
		Soil quality		FAO, soil quality map : http://www.fao.org/soils-portal ISRIC : • http://www.isric.org/content/data • http://www.nrcs.usda.gov See example for EEA member countries: http://www.eea.europa.eu/data-and-maps/indicators
	Land use / land cover changes	**Built up area changes from agriculture and forest**	Article 9 Economic Activities, 2, (a)	ESA Globcorine : http://pegasosdi.uab.es/viewer/ Global Land Cover 2000 database. European Commission, Joint Research Centre, 2003: http://bioval.jrc.ec.europa.eu/products
	Forest fires and droughts	**Area burned by forest fires**	Article 10 Specific coastal ecosystems	FAO, EFFIS See example for EEA member countries: http://www.eea.europa.eu/data-and-maps/indicators
		Occurrence of forest fires		FAO, EFFIS See as an example for EEA member countries: http://www.eea.europa.eu/data-and-maps/indicators
	Soil erosion and deficiency	**Loss of arable land**	Article 23 Coastal Erosion	Land degradation : FAO, ISRIC, UNEP http://www.isric.org/projects
		Percentage of salinized soil		Land degradation : FAO, ISRIC, UNEP http://www.isric.org/projects

Field	Issue summary	Indicator title	Policy objectives from ICZM protocol	Data source / data providers / examples (international)
CLIMATE	**Extreme events by type *(drought, flash floods, strong winds, heat waves, storm surges)***	**Number of extreme events by type per year.**	Article 22 Natural hazards	WMO, http://www.euro-cordex.net See example for EEA member countries : • http://www.eea.europa.eu/data-and-maps • http://www.eea.europa.eu/data-and-maps
	Increase of GHG emissions	**National GHG emissions**		• http://unfccc.int/ghg_data/items/3800.php • http://cdiac.ornl.gov/trends/trends.htm See example for tEEA member countries: http://www.eea.europa.eu/data-and-maps
		Breakdown of GHG emissions per sector		• http://unfccc.int/ghg_data/items/3800.php • http://cdiac.ornl.gov/trends/trends.htm
HEALTH	**Diseases (incidents) related to climate change**	**Mortality due to heat waves**	Article 22 Natural hazards	See example for EEA member countries: http://www.eea.europa.eu/data-and-maps
BIODIVERSITY	**Invasive species**	**Area covered by non-native marine plants**	Article 10 Specific coastal ecosystems	http://www.eea.europa.eu/data-and-maps
	Threatened species	**Number of threatened species**		IUCN, http://cmsdocs.s3.amazonaws.com
	Effect of water temperature increase on marine biodiversity	**Sea surface temperature**		• http://gnoo.bo.ingv.it/mfs/B4G_indicators/SST.htm • See example for EEA member countries: http://www.eea.europa.eu/themes/coast_sea
	Protected area	**Percentage of coastal and marine protected areas effectively managed**	Article 10 Specific coastal ecosystems	*NA*
		Effective management of the protected areas		*NA*
GOVERNANCE	**National and local development plans/strategies integrating CC**	**Existing national and/or local plans/strategies integrating CC adaptation measures**	Article 7 Coordination Article 14 Participation Article 18 National Coastal Strategies, Plans And Programmes	*NA*
	Level of mainstreaming CC adaptation in the implementation of national policies	**Resources and funds available to implement national and/or local strategies integrating CC adaptation measures**		*NA*
		Number of institutions / Publications / People		*NA*
	Risk Management	**Economic losses**		See example for EEA member countries: http://www.eea.europa.eu/data-and-maps

Field	Issue summary	Indicator title	Policy objectives from ICZM protocol	Data source / data providers / examples (international)
POPULATION & URBANISATION	**Population growth in coastal areas**	**Population growth in coastal areas**	Article 8 Protection and sustainable use of the coastal zone	http://sedac.ciesin.columbia.edu/data/collection/gpw-v3
		Population density in coastal areas		http://sedac.ciesin.columbia.edu/data/collection/gpw-v3
	Populations at risk	**Population potentially affected by the sea level rise**		http://sedac.ciesin.columbia.edu/data/collection/lecz
SEA & COAST	**Shoreline protection**	**Percentage of the coast with protection**	Article 23 Coastal Erosion	*NA*
	Zones potentially affected by floods	**Area of coastal zone flooded**	Article 22 Natural hazards	*NA*
	Zones potentially affected by storm surges	**Coastal area at risk from storm surges**	Article 22 Natural hazards	*NA*
	Coastal erosion	**Percentage of eroded coasts**	Article 23 Coastal Erosion	*NA*
	Sea level rise	**Percentage of land exposed to the sea level rise (percentage of exposed urban zones)**	To prevent and/or mitigate the effects of natural hazards and in particular of climate change, which can be caused by natural or human activities. Article 22 (Natural hazards) Article 23 (coastal erosion)	The Permanent Service for Mean Sea Level (PSMSL) is the global data bank for long-term sea level change information from tide gauges. The relative sea level data can be obtained from their website http://www.psmsl.org/ In order to construct time series of sea level measurements at each station; the monthly and annual means have to be reduced to a common date.
		Sea level rise		See as an example for the EEA member countries : http://www.eea.europa.eu/data-and-maps
	Sea acidification	**Acidity of sea water (pH)**		http://www.eea.europa.eu/data-and-maps/indicators
TOURISM	**Extension of the tourism season**	**Number of nights beyond the peak period**	Article 9 Economic Activities,2, (d)	World Tourism Organisation

Note: The international data sources shown in this table are provided as examples of similar data sets or indicators. The level and/or the scale of the information are generally not adapted to the costal zones of the Mediterranean countries.

V. Data sources and data providers

Tables 6 and 8 (in annex) list the national networks of observation stations related to systematic observation of climate change in the different sub-regions. Although several countries did not provide details of their observation stations, almost all of them have synoptic, climatic, meteorological, rainfall and hydrological monitoring stations.

Some countries are participating in international efforts in global observing systems relating to climate change, through collaboration and cooperation with regional and international organisations. These programmes include the Global Climate Observing System (GCOS), and the Global Ocean Observing System (GOOS). Several participating countries mentioned technical cooperation with neighbouring countries through sub-regional networks. Other data sources were also identified:

- Data available from the World Weather Information Service (WMO)
- Climate data from the Algerian National Office of Meteorology (ONM)
- Collection of physical, climatic, hydrographic, oceanographic data, and information related to development indicators (population growth, health, economic activities, etc.)
- Fieldwork campaigns, *in situ* physicochemical measurements and laboratory analysis.

Table 6. National networks of observation stations contributing to systematic observation

	Meteorological stations	Climate stations	Synoptic stations	Rain gauges	Hydrological stations	Marine &coastal stations			Air observing stations	Satellite stations	Other stations
						Tide g	SST	Sea water			
Balkan Countries											
Croatia	X	X	X	X	X	X	X				Phenology
BiH	X		X								
Montenegro	X	X	X	X							
Albania	X	X	X	X	X	X	X	X			
North African Countries											
Egypt	X	X	X	X	X	X	X	X	X	X	
Libya											
Tunisia	X	X	X	X	X	X	X	X			
Algeria	X	X	X	X	X			X	X		
Morocco	X	X	X	X	X	X	X	X	X	X	
Middle East Countries											
Syria	X	X		X							
Palestine	X	X		X							

Source: "Regional experience on assessing impacts of climate variability and change in the Mediterranean area (for GEF Eligible countries)". Technical Report, April 2011, Groupe de Recherche «Environnements Côtiers et changements Climatiques» Université Mohamed V, Rabat, 117p.

For coastal zones, some of the countries have observation systems for sea- level and seawater changes (such as Croatia, Albania, Egypt, Tunisia and Morocco), and a few of them keep track of coastal ecosystems and biodiversity changes (such as Albania, Egypt and Tunisia). Countries involved in MedPOL have a basic pollution monitoring network. One of the main barriers that seems to hamper the observation networks is the lack of an integrated, coordinated and standard approach in the national arrangements for the collection, storage, quality control and dissemination of climate observation data. Several countries stressed their need to develop, extend and/or modernise their

national climate observation systems. They highlighted their limited national budgets, inadequate funding, technical support and limited human capacity for research and observation. Some participating countries reported a problem of depleted stocks of instruments and equipment (Balkans, Palestine).

One of the priorities that emerged was the need to improve the capability of institutions involved in the collection, processing and maintenance of data and information relating to areas such as meteorology, hydrology and climatology.

VI. Main gaps identified at the regional level

a. Monitoring system for CVC impacts on coastal zones

Overall, the following gaps are among the most common to almost all of the participating countries (PCs). These gaps concern human & financial, technologies and models and communication aspects.

As far as the human and financial aspects are concerned:

- Many of the PCs lack capacity and human resources to conduct integrated assessments to evaluate the impacts of climate variability and change on different priority sectors of the coastal zone.
- Projects and programmes for assessing CC impacts appear to have been initiated and conducted thanks to multilateral funds. Few of the projects have been driven by a national need to deal with CC issues.
- University education in most of the participating countries does not provide adequate education to meet the challenges of CC, coastal zone and water management.
- Lack of cross-sector coordination on issues linking climate change and the coastal zone.

As far as technologies and models are concerned:

- Lack of regional climatic prediction models. Additional capacity-building is required to improve the downscaling of climate models, the accuracy of precipitation modelling and early warning of extreme events and disasters such as flash floods, tsunamis, dust storms and droughts.
- In many of the PCs, socioeconomic data are either unavailable or available but in unsuitable format.
- Technical and financial support is urgently needed to establish research programmes with teams from existing universities and research institutes.
- Uncertainty in climate elements and interactions, including nonlinearities, feedback loops, and delays. Globally, there is a poor understanding of the link between CC and extreme events.

As far as the Communication aspect is concerned, the most important aspect seems to be that scientific results on CC impacts need to be communicated in appropriate form to the relevant national stakeholders so that the necessary actions can be taken.

One of the major capacity gaps identified in this analysis is the lack of scientific networks and cooperation among them to promote and conduct good social and ecological science, and develop ways to integrate science into coastal policy-making at sub-regional and regional levels.

b. Data

Most of the proposed indicators need to be calculated for the coastal regions. Even if international sources could be useful for the national level and as examples, indicators need to be calculated based on local information gathered from the national and local institutions. Moreover, geographical information from international sources is not available over a long period and the scale is not adapted to coastal regions.

Calculation of CVC indicators for coastal regions requires improved coordination between national and local information sources and a joint effort on the part of these institutions in order to better harmonise and share needed information.

Even if national infrastructures exist, it is clear that calculation of the proposed indicators is still largely subject to uncertainty, which could cause a lack of diagnostics related to the targeted phenomenon. This risk is related to several aspects including:

- Non availability or lack of a reliable database,
- Lack of a regulatory framework to ease the collection of necessary data from different sectors (public and private),
- Need to improve new statistical knowledge used in the calculation of indicators.

Conclusion

The workshop held at Plan Bleu in November 2014 and this report and the broader ClimVar project provided a first step and set the wheels in motion to create a process at the regional level to discuss the technical feasibility of developing a regional core set of indicators for CVC and ICZM.

The idea was put forward that the core indicators could be a part of developing a wider "regional early warning system alert". There is a need for one or more countries to take the lead. Some experts said that there is a need for a regional leader to oversee the climate risk management system. The leadership role could be held by an international institution (UNEP MAP, CMCC, etc.) or by a consortium which share the same geographical locations (some Mediterranean countries) and issues/sectors.

Monitoring indicators is active process that would be worth being accompanied by the creation of a permanent working group (open to experts and governments) as is already done with the ISDR (to ensure and promote disaster risk reduction) and WMO.

The UN-ISDR participates in the development of indicators. The design and implementation of a strong framework of indicators will be critical in providing meaningful and reliable information to ensure and promote disaster risk reduction. To support dialogue between the open-ended intergovernmental expert working group on Sendai Framework indicators and the Inter-Agency and Expert Group (IAEG) on SDG indicators from a technical perspective, UNISDR facilitates discussion on DRR indicators across sectors and in society.

The World Conference recommended the establishment of an open-ended intergovernmental expert working group, comprised of experts appointed by Member States, and supported by the United Nations Office for Disaster Risk Reduction with involvement of relevant stakeholders. It would develop a set of possible indicators to measure global progress in the implementation of the Sendai Framework in conjunction with the work of the inter-agency expert group on sustainable development indicators. The Conference also recommended that the working group consider the recommendations of the UNISDR Scientific and Technical Advisory Group on the update of the "2009 UNISDR Terminology on Disaster Risk Reduction".

The following items regarding the work done on "CVC and ICZM indicators" should be highly considered. First, regarding the observations on which the calculations are based, Plan Bleu noted that there are major differences between countries in terms of data produced and data available. There is also a difference in terms of available data on ocean and atmosphere components. Finally, there are disparities in data backup, layout and exploitation.

There is a need to define common trans-Mediterranean challenges and develop a regional climate change adaptation strategy. The proposed core indicators presented in this report could help in following the adaptation strategy.

In addition to the abovementioned Plan Bleu discussions, the following main recommendations are taken from a report drafted in 2011 by CMCC[4]. To enhance the indicators-based studies over the Greater Mediterranean Region (GMR):

- Enhance the rescue of old climate and marine data in countries of GMR, in particular in the southern portion;
- Use the updated output models specifically produced for the GMR to develop climatic, marine, vulnerability and adaptation indicators for future periods across the GMR;
- Continue to improve hydrological programmes for monitoring water resources aimed to build long-term hydrological data series including important variables such as surface discharge, evapotranspiration and groundwater storage and flux;

[4] "Assessment of regional experience on climate variability and change monitoring and predictions in the Mediterranean area", CMCC, April, 2011, 115p.

- Enhance the abilities of countries in the GMR to meet GCOS, regional and national requirements for climate observations and information to support decision-making related to climate and its impacts;
- Improve domestic coordination between national institutions and agencies to ensure an effective and cost-efficient response to GCOS, national governments and other clients' requirements for climate data and information;
- Enhance the National Reports submission from the countries to UNFCCC on the status of their national programmes for systematic observation of the climate system, in accordance with GCOS guidelines;
- Enhance the development of vulnerability assessment for coastal areas by using vulnerability indicators and indices;
- Apply coastal vulnerability maps and indices to assess policy effectiveness / efficiency;
- Fulfil the need for analysis of adaptation policy measures (e.g., cost-benefit analysis);
- Enhance the estimates of economic costs of climate change;
- Enhance the usage of adaptation indicators.

Decision-makers face some limits in terms of knowledge of CVC indicators at the regional level. The vulnerabilities and impacts of climate change on activities (e.g. Tourism) are not known very well so relevant indicators are necessary to measure them.

Moreover, tools used are not always the best-suited to model or measure impacts of climate change on coastal zones and therefore increase challenges to monitor these areas.

Appendix

Table 7. Reviewed list of Indicators following a technical workshop hosted at Plan Bleu in November 2014. The "total score" column comes from the RACER method, presented in section 4.1

Field	Issue summary	Indicator title	Units	COMMENTS	Total score
WATER	Changes in seasonal river flow	Number of days with low-water flow	Nb		10.00
	Quantity and quality of groundwater resources	Overexploitation of groundwater	%	Due to CC	9.47
		Irrigation water requirement	m^3	Due to CC	8.47
	Quality of coastal water	Salinity in coastal aquifers	%		9.33
LAND	Soil degradation	Rate of land abandonment	%	Could be deleted	8.80
		Soil quality	%	Use the "Soil moisture" to monitor the soil quality instead of "soil quality"	9.13
	Land use / land cover changes	Built up area changes from agriculture and forest	%		9.67
	Forest fires and droughts	Area burned by forest fires	ha	To be analysed with occurrence.	10.00
		Occurrence of forest fires	Nb	To be analysed with area. This could therefore be deleted.	10.00
	Soil erosion and deficiency	Loss of arable land	%	Available every 5 years	9.67
		Percentage of salinized soil	%	Not easily available	9.13
CLIMATE	Extreme events by type *(drought, flash floods, strong winds, heat waves, storm surges)*	Number of extreme events by type per year.	Nb	"Nb of days" and "nb of nights" have to be considered for "Heat waves". "Storm surges" has been added in the issue column.	10.00
	Increase of GHG emissions	National GHG emissions	CO2 t equivalent		10.00
		Breakdown of GHG emissions per sector	%	Could be deleted	10.00
HEALTH	Diseases (incidents) related to climate change	Mortality due to heat waves	Rate	An indicator related to Air pollution could be added. What about DALY (Disability-Adjusted Life Year)?	10.00
BIODIVERSITY	Invasive species	Area covered by non-native marine plants	Km^2	Only the marine part is considered. What about land species? Only marine plants are considered. What about animals? Unit has been changed into km2 (not %)	8.13
	Threatened species	Number of threatened species	Nb / %	Here "threatened" is related to the red IUCN list. Countries could also refer to their own national lists to complete.	8.60
	Effect of water temperature increase on marine biodiversity	Sea surface temperature	°C	Is a "core indicator"	10.00
	Protected areas	Percentage of coastal and marine protected areas effectively managed	%	RAC/SPA gives a reference definition of "effectively": human and financial resources are available and secured. Has been moved from "Coast" to "Biodiversity".	7.93
		Effective management of the protected areas	(Surface, Number, %)	Interesting but comments/questions remain for RAC/SPA. Has been moved from "Land" to "Biodiversity"	8.80

GOVERNANCE	National and local development plans/strategies integrating CC	Existing national and/or local plans/strategies integrating CC adaptation measures	Yes / No		7.07
	Level of mainstreaming CC adaptation in the implementation of national policies	Resources and funds available to implement national and/or local strategies integrating CC adaptation measures	Euros	To measure the level of actions in policies.	6.53
		Number of institutions / Publications / People	Nb		8.73
	Risk Management	Economic losses	Euros	Risk management need for cooperation with insurance and Investment Banks	9.33
POPULATION & URBANISATION	Population growth in coastal areas	Population growth in coastal areas	%	Add reference to the "gender" (male/female) and "age" (old/young) using WHO standards.	10.00
		Population density in coastal areas	Inhab / km^2		10.00
	Populations at risk	Population potentially affected by the sea level rise	%	Has been moved from "Coast" to "Population & Urbanisation"	8.00
SEA & COAST	Shoreline protection	Percentage of the coast with protection	%	Here hard protection (dikes / beaches nourishment) is considered. What about soft measures?	7.47
	Zones potentially affected by floods	Area of coastal zone flooded	Km^2	Unit changed: from % to km^2	9.00
	Zones potentially affected by storm surges	Coastal area at risk from storm surges	%	The definition of the Coastal Zone is given by the ICZM protocol but this area may differ depending on countryspecifics. How should this indicator be measured: using existing data or projections?	7.80
	Coastal erosion	Percentage of eroded coasts	%		6.93
	Sea level rise	Percentage of land exposed to the sea level rise (percentage of exposed urban zones)	%	Percentage of urban zones exposed to SLR	7.00
		Sea level rise[5]	mm	Is a core indicator	10.00
	Sea acidification	Acidity of sea water	pH	This indicator is very straightforward, tied to: Chlorophyll and Sea production	10.00
TOURISM	Extension of the tourism season	Number of nights beyond the peak period	Nb / %	The wording "Peak period" created debate. Definition: "the season when travel is most active and rates are highest". In the Toolkit “European Tourism indicators”, this indicator is used. The issue is "Tourism Flow at destination" and the indicator is "Number of 'same day' visitors in high season and low season". So Plan Bleu suggests keeping this indicator and expects to measure it if CC has an impact on tourist behaviour and extends the "high season/peak season".	6.80

[5] SLR indicator is relevant but, as an aggregate indicator, is difficult to consider at the regional level. The sea level is expected to decrease in some marine areas and to increase in others. Based on a report from EEA, this indicator (SLR) and its results stem from a modelling chain from the global to local level. Moreover, it is necessary to consider other local parameters such as subsidence, etc.

According to Tunisia, one indicator regarding “Health” is not enough. During the workshop in November 2014, Tunisia suggested that another indicator could be: “the number of flood victims. This indicator is obtained from the Civil Protection response to floods. This indicator could be calculated for 10 years, i.e “the total number of victims following coastal floods, experienced in 10 years”.

According to Egypt, the indicators “Economic losses” (Risk management issue) is not easy to count.

To answer the following recommendation: "collection of data on indicators on physical impacts of climate variability and change at the regional level", the appendices below provide sources for each participating country. Moreover the available data identified in Component 1 of the ClimVar project must be referred to along with other existing literature on climate change scenarios and impacts.

Table 8. Observation networks and databases (From National Communication and National reports)

Country	Monitoring /Observation Programmes	Parameters monitored	Responsible Institutions	Remarks
Balkans				
Croatia	41 main, 117 climatological, 336 precipitation and 23 rain storage stations. >100 hydrological 30 phenological 5 marine stations for sea-level including approximately 30 sea surface temperature gauges	Soil temperature, soil moisture, pan evaporation, solar radiation Sea surface temperature Sea level	Meteorological and Hydrological Service of Croatia	available in electronic ASCI format Data since 1980
Bosnia and Herzegovina (BiH)	In Republic of Srpska: 26 meteorological stations, out of which two are Class 1 weather stations In FBiH: 13 professional weather stations		Ministry of Foreign Trade and Economic Relations of BiH	need to further modernize the network by the introduction of Automatic Weather Stations and connection into a system of automatic monitoring together with hydrological stations
Montenegro	8 main automatic stations, 20 climatic and 80 precipitation stations	Wind speed and direction, temperature, precipitation and sunshine hours, pressure, sea temperature, relative humidity and visibility.	Hydro meteorological Institute of Montenegro	data are stored in the digital Oracle database
Albania	Meteorological network *: 126 stations* Hydrological network *:* 103 stations (6 on the seacoast and lagoons)	All weather parameters water level, river discharge, tide parameters, wind, water temperature and some chemical elements	Institute of Energy, Water and Environment, Ministry of Environment	Data stored in paper format and only a part of it is in electronic format. They are currently in the process of digitizing data.
North Africa				
Egypt	112 stations including surface and atmospheric stations, air pollution, global radiation and agro-meteorological stations Satellite Systematic Earth Observations: 26 agro-meteorological stations 7 Tide gauge stations in the Delta and on the Mediterranean coast	CO, NOX, O3, TSP and SO2 Total coliforms, ISO 56679; Ecoli, ISO 9308-1; Fecal Streptococci, ISO 78992 Depth; salinity; conductivity ; pH; temperature; dissolved oxygen; transparency Nitrite; nitrate; total phosphorus; total nitrogen; ammonia; reactive phosphate; Chlorophyll–a.	Central Agency for Population, Mobilization and Statistics, Egyptian Meteorological Authority Egyptian Environmental Affairs Agency (EEAA), Institute of Graduate Studies and Research, National Authority of Remote Sensing and Space Sciences, Ministry of Water Resources and Irrigation,	EEAA has created a website where these data are published
Libya				
Tunisia	26 synoptic stations 34 agro-meteorological 54 climatological stations 182 rain stations	All atmospheric parameters Sea level	Institut National de la Météorologie	This network is being automated Database in digital format

Algeria	79 synoptic stations, 40 climatological stations 10 automatic Stations with transmission in real time in the Wilayaof Algiers 125 automatic monthly climatological stations Network of air quality control	All atmospheric parameters water quality (including bathing water) Air quality	Office National de la Météorologie Agence Nationale des Changements Climatiques Agence spatiale algérienne	
Morocco	44 Synoptic meteorological stations 4 numerical tide gauges recently installed 19 Air quality stations Hydrological network: 265 hydrometric stations, 710 Periodic gauging points; 209 monitoring stations for superficial water and a network of 480 stations for groundwater Flood warning network 188 Radio transceiver posts) Drought Observation Network	All atmospheric parameters water quality (including bathing water) Air quality Acidity of rainwater in some cities Sea level	National Meteorology Directorate, General Directorate of Hydraulics, Directorate of Statistics, Department of Environment, National Research Institute for Fisheries, and other Research Centres	
Middle East				
Syria	Over 30 monitoring stations distributed across the coastal area	temperature, relative humidity and precipitation	General Directorate for Meteorology Other governmental institutions	Most of available monitoring data from existing networks are either not continuous in time and space, and/or with limited accuracy due to the physical state of some monitoring stations.
OtP	12 partially functioning metrological stations in Gaza	temperature, rainfall precipitation, and humidity and wind speed	Palestinian Ministry of Transportation, Environmental Quality Authority	Meteorological data available from 1973 to 2010

Source: "Regional experience on assessing impacts of climate variability and change in the Mediterranean area (for GEF Eligible countries)". Technical Report, April 2011, Groupe de Recherche «Environnements Côtiers et changements Climatiques» Université Mohamed V, Rabat, 117p.

Table 9: Gaps and needs for each participating country

Country	Constraints / Gaps / Needs
Balkans	
Croatia	-Lack of technical and scientific research on vulnerability to climate change and adaptation -Low level of knowledge and lack of funds for research programmes -Need to improve the existing system for the collection of data relating to sea level changes, sea current directions and forecasts of wind waves along the eastern Adriatic coast - Need to prepare detailed scientific and expert studies to estimate the maximum area of the coast that will be flooded or periodically flooded, the population exposed to flooding effects and the penetration of salt water into freshwater reservoirs. - Need for monitoring and recording hydrological and meteorological data assessment of climate change impacts on evapotranspiration and discharge; -Need for preparation of regional studies of expected climate change impacts on water resources. -Implementation of multidisciplinary oceanographic and hydrographic research into the Adriatic Sea and identification of the process of interaction between climate and marine ecosystems; -Establishment of permanent monitoring of fish species that are biological indicators of changes in hydrographic properties of the sea; -Identification of particularly vulnerable areas by sector - Need to increase scientific and research work in the field of vulnerability and adaptation; -Ensuring sustainable management of natural resources and integration of climate change issues; -Education and dissemination of information in order to develop awareness on the impacts of climate change on human health.
Bosnia and Herzegovina	- Lack of experience, insufficient capacity - Inadequate collaboration and exchange of information among institutions - No comprehensive environmental policy at the national level - No institution entirely dedicated to environmental protection issues - Lack of financial transparency in the environmental sector - Awareness of causes and potential consequences of climate change is low. - Need to assess the implications of development in the context of reduced water resources. - Need to improve the water management system. - Need to assess the impacts of climate change on hydrology and water resources and the water management system. - Assess the socioeconomic effects of ecosystem loss. - Develop the elements of an activity plan for the prevention, decrease and mitigation of negative socioeconomic impacts. - Manage protected areas and special interventions needed at given locations - Educational institutions at the national level should adopt an education strategy on climate change for formal education at all levels - Introduction of indicators for monitoring achievements

Montenegro	- Lack of technical and scientific research on vulnerability to climate change and adaptation - Exchange of information among different institutions is not satisfactory - Cooperation between the research sector and policy makers is not satisfactory - Level of knowledge and understanding on the impacts of global climate change on terrestrial and marine ecosystems and biodiversity is very limited - Experts, information and knowledge in this field are lacking. - Capacities to assess impacts of climate change on human health are insufficient. - Severe lack of funds for research programs on vulnerability and adaptation, as well as for support for the work of expert and/or advisory bodies -- - Strengthen human and technical capacities within overall institutions - Need to improve support for scientific research - Need to improve cooperation /exchange of information among all stakeholders - Need to establish databases by sector and ensure that they are updated regularly. - Need to collect necessary data for the assessment of impacts of climate change on biodiversity - Need of training for experts and awareness raising - Need to increase the technical capacities for monitoring and updating basic data sets - Modern tools for vulnerability assessment in almost all vulnerable sectors (hardware, software and training of personnel) - Training of national experts, both for running climate change scenarios (models) and for assessment of climate change and variability impacts; - More detailed regional climate change models as well as methods for simulating extreme weather events - Development of socio-economic scenarios - Production of climate change risk maps.
Albania	- No monitoring of the climate change effects on coastal areas. - Lack of understanding of factors determining the resilience and adaptive capacity of ecosystems, including the roles of habitat extent, connectivity and quality, flow rates, and disturbances; - Need to assess coastline changes and the effect of river basins in this phenomena; - Need to analyse species, habitats and ecosystems most vulnerable to climate changes; - Need to analyse present and future social and economic situations - Improvement of data collection and reporting on activity in the key sectors, - Strengthen the capacity of research institutions for key climate change issues (energy efficiency, reforestation, agricultural practice, etc.). - Need for a network of automatic meteorological stations - Need for a network of automatic hydrological stations - Need for sea level and shoreline monitoring - Need for modernisation of hydraulic laboratories - Need to strengthen capacity in satellite remote sensing and Geographical Information Systems (GIS) - Warning system for abnormal phytoplankton blooms - Fast screening tests for detection of bio-toxins in shellfish species.
North Africa	
Egypt	- Vulnerability assessment of the coastal zone in view of adopted sea level rise scenarios

	- Monitoring, modelling and assessment of impacts of salt water intrusion on soil salinity. - Monitoring, modelling and assessment of potential impacts of climate changes on coral reef and impacts on tourism - Socioeconomic consideration of immigration of vulnerable communities and employment considerations in safe areas - The establishment of proper systematic observation systems, monitoring networks and institutional information systems on sea lever rising to support decision-making. - The systems' primary objectives would be to identify vulnerable areas, build databases, develop and implement measures for resource protection, and follow up and enforce planning regulations - The institutionalisation of systematic observations of sea surface temperature, coastal land use and sea level variations, ensuring the availability of results for the scientific community and policy makers. - The establishment of a network of tide gauges across the Mediterranean, the Red Sea, and Lake Nasser. - The establishment of institutional capacities for monitoring coastal and sea surface temperature variations in the Red Sea, Lake Nasser and Lake Qarun. - Maintaining and improving disease surveillance systems for monitoring incidences and prevalence of diseases vulnerable to climate change,
Tunisia	-Improve studies on climate variability, its predictability and possible changes; -Assess the ecological and socioeconomic vulnerability of the country to the impacts of climate change -Improve climate modelling -Define the most appropriate way to integrate climate change concerns into all development projects; -Consolidate the National Committee on Climate Change and establish a permanent national unit working on climate change. -Access to the most recent information and scientific knowledge on CC - Acquire know-how in the field of evaluation and monitoring of sea levels, and direct and indirect effects of climate change on natural ecosystems and economic activities such as agriculture and health. -Facilitate access to predictive models used in the field of climatology -Conduct consistent studies in the field of vulnerability and adaptation, especially on aspects related to the economic assessment of vulnerability and adaptation costs.
Algeria	-Improved collection and management of climate data and other relevant data. -Establishment of a system to monitor changes in sea level, coastal erosion and sea water temperatures. -Establish a dashboard for monitoring the parameters mentioned above in the areas most vulnerable to CC -Improve communication between all structures and stakeholders involved in climate change impact studies. -Need for cooperation projects and technology transfer in monitoring and modelling coastal erosion and vulnerability assessment. -Strengthen local capacity to enable them to participate in regional and subregional systematic observation networks -Improve and implement effective information

Morocco	- The existing observing and monitoring networks are not integrated and are poorly optimised - Lack of financial resources for the implementation, operation and development of systematic observation networks -Institutional fragmentation hampers the communication of results on CC projects managed by different implementing institutions - Lack of consistent socioeconomic scenario specific to the local/national context - The use of high resolution models or downscaling techniques is not easy because of their prohibitive cost and/or lack in human capabilities - Need for modernisation of information systems and capacity building and skills - Need to meet legal, institutional and organisational needs in the field of research and development and systematic observation
	- Need to improve information exchange and participation in exchange networks; - Need for training specific to climate change, particularly concerning the use of data from space observation and new technologies information; - Need to develop relevant indicators to characterise the vulnerability to CC impacts in areas that could be affected directly or indirectly at the national, regional or local level. - Need to harmonise collection, storage and data compilation methods.
Middle East	
Syria	- Lack of analytical tools and technical capacity for data processing (data interpretation process for transforming the data into information useful for decision-makers). - Lack of data on historic sea level rise along the coastal area. - Lack of data in all main sectors. - Limited expertise in scenarios modelling. - The meteorological monitoring networks operated by the various national institutions are not integrated - Missing data in the daily and monthly climatological time series - Permanent problems in operating monitoring stations, slow modernisation of equipment and degradation of the existing monitoring network. - Lack of regional climatic prediction models and downscaling models - Lack of well developed methodologies and tools for undertaking vulnerability and adaptation studies especially for health and socioeconomic sectors. - Lack of financial resources to address needs, conduct research and studies, and implement adaptation measures. - Socioeconomic data are either unavailable or available in unsuitable format. - Need for enhancing technical capacity for monitoring and data collection, data management and updating basic data sets, and preparation of basic maps and databases. - Capacity building is needed in the area of methodologies, tools and guidelines to conduct V&A studies. - Need to improve meteorological, air quality and water monitoring through modernisation of equipment and extension of monitoring networks. - Conduct studies and research to assess adverse impacts and vulnerability to climate change in different sectors of all potentially vulnerable areas of Syria.

Palestine	- Available data is scattered, and is collected by different institutions without adequate coordination. - Data is not always effectively processed, screened and evaluated, - Limited legal frameworks for disaster risk reduction, which are response-led rather than preventive. - Underdevelopment of policies for disaster preparedness, mitigation, and emergency response - Weak capacity in disaster management and rescue operations. - Need to develop and implement a national monitoring programme for climate variability and change. Mainly for water quality and availability, marine and coastal biodiversity and fisheries. - Strengthening the capacity for modelling (running scenarios/models) and downscaling to more detailed climate change models to be applied for the coast - Strengthening the national institution specialised in climate variability and change especially in monitoring, research and modelling and also strengthening the capacity for climate change monitoring in terms of legislation, institutions, and facilities; - Identifying climate impacts in the oPt by means of environmental monitoring networks and the development of forecasting capacity; - Monitoring the climate vulnerability of sectors and communities at risk; - Sustained access of individuals to sufficient safe water for health and wellbeing in the face of significant climate risks (e.g. water scarcity and reduced quality).

Source: "Regional experience on assessing impacts of climate variability and change in the Mediterranean area (for GEF Eligible countries)". Technical Report, April 2011, Groupe de Recherche «Environnements Côtiers et changements Climatiques» Université Mohamed V, Rabat, 117p.

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http://www.climateadaptation.eu/

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RACER method

http://www.sei.se/eipot/resources/EIPOT-RACER-evaluation-framework-final-07Oct08.pdf

UNISDR - Disaster Risk Reduction

Open-ended intergovernmental expert working group:
http://www.preventionweb.net/drr-framework/open-ended-working-group/

UNISDR input to the development of indicators: http://www.preventionweb.net/drr-framework/open-ended-working-group/indicators/

UNISDR input to the update of Terminology on Disaster Risk Reduction: http://www.preventionweb.net/drr-framework/open-ended-working-group/terminology/