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Agenda item 5.6: Draft Decision on Regional Climate Change Adaptation Framework (RCCAF)

Background document to the Regional Climate Change Adaptation Framework

UNEP/MAP
Athens, 2015

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1 INTRODUCTION

1.1 Scope and structure of the report

The present report, submitted as an Information Document to the MAP Focal Points Meeting in Athens (13-16 October 2015), is a background document accompanying the draft "*Regional Climate Change Adaptation Framework for the Mediterranean Marine and Coastal Areas*". It was prepared in the context of the GEF-funded "*Integration of climate variability and change into national strategies for the implementation of the ICZM Protocol in the Mediterranean*" (ClimVar & ICZM) project which supported the finalization of the draft Framework.

The aim of this report is to provide an overview of key concepts and perspectives around adaptation to climate change, of the latest knowledge regarding the climate change-related challenges that the Mediterranean is facing, of the relevant national and international capacities and efforts, of recommended responses and approaches and of available and emerging financing options.

The introduction provides a brief discussion on how sustainable development and adaptation to climate change are interrelated, as well as the major activities under the UNEP/MAP system relevant to climate change in the Mediterranean region.

Chapter 2 presents a brief overview of the latest scientific knowledge on how the region's climate is changing and how it is predicted to change in the course of the century.

Chapter 3 provides an overview of the current status of knowledge regarding the risks and vulnerabilities of the region's natural and human systems in the face of climate change, and also present the methodology and results of the application of a Coastal Risk Index at the regional and local scale in the Mediterranean that was carried out in the context of the ClimVar & ICZM project.

Chapter 4 describes the international adaptation-related developments under the UNFCCC process, the current status of the national adaptation legislative framework in the countries of the Mediterranean and the relevant international and regional initiatives.

Chapter 5 presents five dimensions or approaches that any adaptation strategy should consider as a priority, namely the implementation of low-regret measures, the synergies between adaptation and both disaster risk management and mitigation, the integration of adaptation perspectives into ICZM, the use of Ecosystems-based adaptation approaches.

Chapter 6 describes the international climate financing framework under the UNFCCC as well as the other international funding opportunities relevant to the Mediterranean region. It also provides a brief discussion on what prioritizing adaptation financing means at the national level as well as on the role of the banking and insurance sectors.

A glossary together with a list of abbreviations and a bibliography of major studies and reports are present in the end of the document.

1.2 Tackling climate change and sustainable development

Climate change is arguably one of the most critical challenges that humankind is facing. There is a scientific consensus, most significantly demonstrated in the recent 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5), that unless urgent and drastic action is taken internationally, we risk severe, pervasive and irreversible impacts on human and natural systems, threatening ecosystems and biodiversity, slowing economic growth, eroding food security, harming

human health and increasing inequality. Developing countries are particularly vulnerable because they are predominately poor, less resilient and lacking the capacity to manage disasters effectively.

The IPCC Report clearly identifies the link between climate change and sustainable development stating that "*Climate change poses a moderate threat to current sustainable development and a severe threat to future sustainable development*". Tackling climate change and fostering sustainable development are essentially two sides of the same coin and forcing distinctions between them would be counterproductive and a missed opportunity at the least.

The IPCC AR5 also brought about a significant development on how we define, understand and assess vulnerabilities, risks and impacts, giving a central role to the concept of climate risks. Until recently, the focus was on the vulnerability of an area to climate change and was typically discussed only in terms of and as a function of the predicted impacts of climate change. However, vulnerability of an area to climate change is dynamic rather than static and is based far more on development conditions (social, economic, institutional) than just on exposure to climate hazards. As the IPCC AR5 puts it, risk of climate-related impacts results from the interaction of climate-related hazards with the vulnerability and exposure of human and natural systems. Changes in both the climate system and socioeconomic processes -including adaptation and mitigation- are drivers of hazards, exposure, and vulnerability.

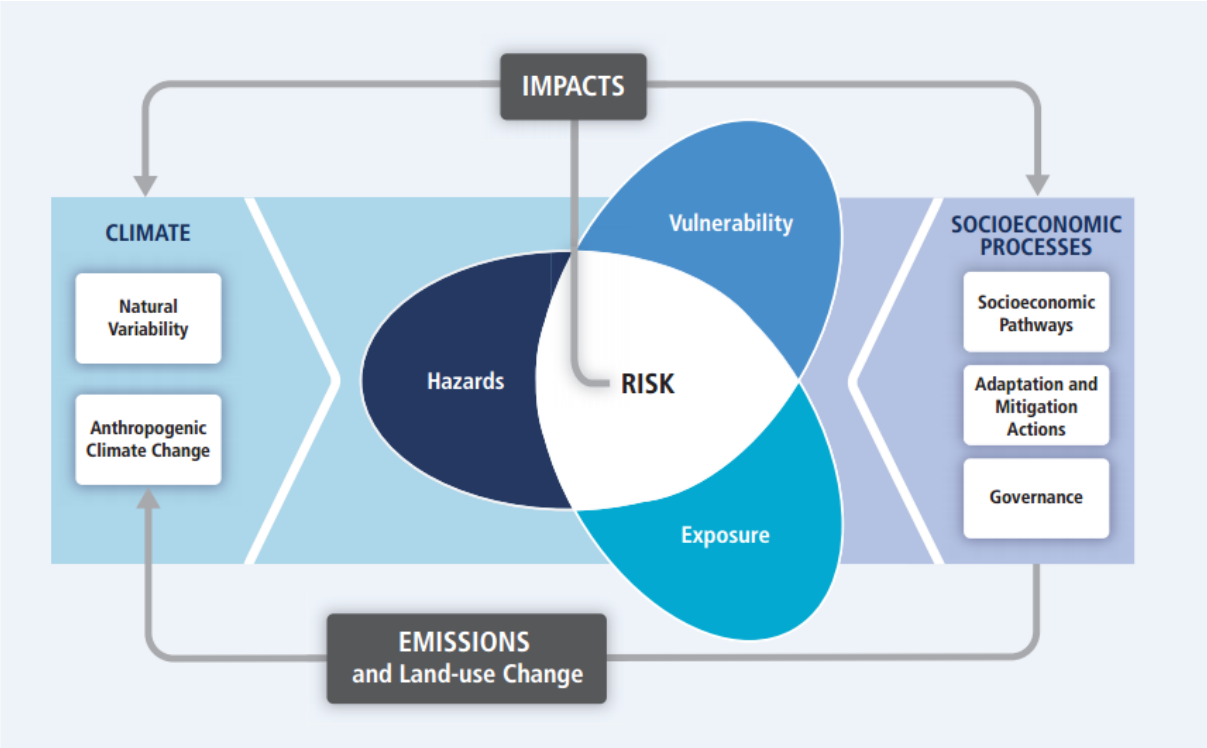

Figure 1: Climate risks as a function of vulnerability, exposure and hazard, and dependent on both climate and socioeconomic processes. Source: IPCC AR5

It should also be noted that aspects of unsustainable development such as environmental degradation, overexploitation of resources, pollution, demographic pressures, unplanned urban growth, political dynamics and migration patterns, not only important drivers of increased vulnerability but are also undermining the capacities of communities and ecosystems to adapt to climate change.

An important concept that the IPCC AR5 introduced in order to promote sustainable development within the context of climate change, is that of Climate-Resilient Pathways which involve two main categories of responses:

- Actions to reduce human-induced climate change and its impacts, including both mitigation and adaptation toward achieving sustainable development

- Actions to ensure that effective institutions, strategies, and choices for risk management will be identified, implemented, and sustained as an integrated part of achieving sustainable development.

The international community is increasingly rising up to the interdependent challenges of sustainable development, tackling climate change and risk management. 2015 is a critical year and a unique opportunity as it marks the conclusion of three international processes which will set the agenda through which the above issues are approached and addressed effectively and coherently in the years to come:

- In March 2015, at the Third World Conference on Disaster Risk Reduction in Sendai, Japan, UN Member States adopted the Sendai Framework for Disaster Risk Reduction (2015-30) which includes seven global targets and sets out four priority areas for further action. The new framework will guide countries in their efforts to achieve a substantial reduction of disaster losses in the future.
- By September 2015, governments will agree on a set of Sustainable Development Goals (SDGs) building on the outcome of the 2012 Rio+20 Conference and the Millennium Development Goals (MDGs). For the first time, these new goals will be designed for universal application.
- In December 2015, a comprehensive global agreement on climate change action is expected to be reached at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC).

The following Table presents the three SDGs that are more relevant to adaptation to climate change in the Mediterranean (ie the ones on climate change itself, on the protection of seas and marine resources, and on the protection of terrestrial ecosystems), including the relevant targets, as they were agreed on 1 August 2015 in the finalized text for adoption "Transforming Our World: The 2030 Agenda for Sustainable Development".

Sustainable Development Goal	Target	Target referring to specific means of implementation
Goal 13. Take urgent action to combat climate change and its impacts	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries 13.2 Integrate climate change measures into national policies, strategies and planning 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible 13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries, including focusing on women, youth and local and marginalized communities
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution 14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans 14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels 14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics 14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information 14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation2	14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries 14.b Provide access for small-scale artisanal fishers to marine resources and markets 14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want

	14.7 By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements 15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally 15.3 By 2020, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world 15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development 15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species 15.6 Ensure fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources 15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both \demand and supply of illegal wildlife products 15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species 15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems 15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation 15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities

Table 1: Sustainable Development Goals 13-15 and respective targets, as agreed on 1 August 2015 in the finalized text for adoption "Transforming Our World: The 2030 Agenda for Sustainable Development". Source: https://sustainabledevelopment.un.org/post2015

1.3 UNEP/MAP activities on adaptation to climate change

At the global level, UNEP has almost thirty years of experience working on climate change, dating back to the establishment of the Intergovernmental Panel on Climate Change (IPCC) with the World Meteorological Organization in 1988 and the support of the negotiation of the UN Framework Convention on Climate Change (UNFCCC), which entered into force in 1994. Beyond its support for science and legal mechanisms, UNEP has been involved in efforts to both reduce emissions of greenhouse gases and to reduce the risks of and improve society's resilience to climate change.

UNEP's major recent initiatives relevant to climate change adaptation include:

- the National Adaptation Plan Global Support Programme which assists countries to bring greater focus and attention to medium and long-term adaptation planning and budgeting;
- the Global Adaptation Network (GAN) which aims to build capacity and improve access to knowledge for adaptation; and
- the Programme of Research on Climate Change Vulnerability, Impacts and Adaptation (PROVIA) which aims to provide direction and coherence for vulnerability, impact and adaptation research, and to support the identification of research gaps and meeting of policy needs.
- the "Ecosystem-based Adaptation" (EbA) Programme which uses biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities adapt to the negative effects of climate change, at the same time providing many other benefits to communities.

At the Mediterranean level, UNEP/MAP has been supporting actions to assess climate change impacts in the Mediterranean marine and coastal zone, dating back to the publication in 1992 of "*Climate change and the Mediterranean: environmental and societal impacts of climatic change and sea level rise in the Mediterranean region*" (Jeftic et al 1992). A comparative analysis of the main findings, conclusions and recommendations of the site-specific case studies were presented in 1996 in the 2nd Volume of the aforementioned edition (Jeftic et al 1996). One of the major observations of these studies was the critical role that coastal zone planning has to play in climate adaptation policies.

Several of the Regional Activity Centers of UNEP/MAP have undertaken studies, such as:

- SPA/RAC, 2008, Impact of climate change on biodiversity in the Mediterranean Sea
- PB/RAC, 2008, Climate Change and Energy in the Mediterranean
- SPA/RAC, 2009, Synthesis of National Overviews on Vulnerability and Impacts of Climate Change on Marine and Coastal Biological Diversity in the Mediterranean Region
- SPA/RAC, 2010, Impact of climate change on marine and coastal biodiversity in the Mediterranean Sea – Current state of knowledge
- PAP/RAC, 2010, Climate Change in Coastal Zones of the Mediterranean - Background Paper & Position Paper
- PB/RAC, 2011, Adapting to climate change in the water sector in the Mediterranean: situation and prospects

The Mediterranean Strategy for Sustainable Development (MSSD), adopted in 2005, included the mitigation of climate change and adaptation to its effects as one of its 7 Priority Fields of Action. The process for the revision of the MSSD (2016-2025) started in late 2014 and the new draft Strategy has climate change as one of its 6 Focus Areas.

The Contracting Parties to the Barcelona Convention endorsed at their 15th meeting (Almeria, Spain, January 2008) the Ecosystem Approach (EcAp) as an overarching principle of the UNEP/MAP system at the strategic level, to be integrated in all its policies and activities, with the ultimate objective of achieving a Good Environmental Status of the Mediterranean Sea. EcAp is a strategy for the integrated

management of land, water and living resources that promotes conservation and sustainable use in an equitable way. UNEP/MAP has undertaken a project aiming at providing support to the Barcelona Convention for the implementation of the Ecosystem Approach. One of EcAp's Operational Objectives is to minimize the impacts induced to the marine and coastal ecosystems by climate variability and change. Close synergies are envisaged in the implementation of the objectives of both EcAp and the Framework.

At the 16th meeting of the Contracting Parties to the Barcelona Convention (Marrakesh, Morocco, November 2009), the "Marrakesh Declaration" adopted by Ministers of Environment and Heads of Delegation agreed to "*Implement effective coordination to ensure the integration of climate change issues into development policies with the aim of achieving the Millennium Development Goals and the objectives of the MSSD, and ensure the strengthening of cooperation for the sharing of experience in the field of surveillance (early-warning systems) and the development and implementation of adaptation and risk-management strategies*".

The 18th meeting of the Contracting Parties to the Barcelona Convention (Istanbul, Turkey, December 2013) adopted UNEP MAP's Program of Work for 2014-15 which had climate change as one of its seven Themes and contained several mitigation and adaptation actions, including the preparation of the Regional Climate Change Adaptation Framework and its review by the MCSD in order for it to be submitted for consideration by 19th meeting of the Contracting Parties to the Barcelona Convention (Athens, Greece, February 2016).

Since 2012, MAP together with PAP/RAC, Plan Bleu and GWP-Med, have been implementing the GEF-funded "Integration of climate variability and change into national strategies for the implementation of the ICZM Protocol in the Mediterranean" (ClimVar & ICZM) project, executed in 11 of the Mediterranean countries. It is a collective effort to promote the use of Integrated Coastal Zone Management (ICZM) as an effective tool to deal with the impacts of climate variability and change in coastal zones in countries sharing the Mediterranean, by mainstreaming them into the ICZM process.

Beyond the development of the Regional Climate Change Adaptation Framework, a number of reports, studies and demonstration projects were carried out in the context of the project, which are available in www.themedpartnership.org. In this document we briefly present

- the "*Application of a Multi-Scale Coastal Risk Index at Regional and Local Scale in the Mediterranean*" report (section 3.4) prepared on behalf of Plan Bleu
- the "*Guidelines for adapting to climate variability and change along the Mediterranean coast*" report (section 5.3) prepared on behalf of PAP/RAC

Furthermore, an "Analysis of Interlinkages between the Draft Regional Climate Change Adaptation Framework and Mediterranean Action Plan, Barcelona Convention, Protocols and Related Strategies and Potential Contributions for their Implementation" has been prepared by UNEP/MAP Secretariat and is submitted as an Information Document to the October 2015 MAP Focal Points Meeting in Athens.

2 MEDITERRANEAN'S CHANGING CLIMATE

2.1 The Mediterranean climate

Confined between Southern Europe, Middle East and North Africa, the climate of the Mediterranean is determined by the interaction between mid-latitude weather regimes, sub-tropical processes and its own complex morphology and is characterized by a high spatial variability in seasonal mean temperature and total precipitation.

Because it is in such a transition area, the Mediterranean basin is very sensitive to global climate change and has been defined as a primary climate "hot-spot" by Giorgi (2006), being one of the two most responsive regions to climate change globally. Recently, the IPCC AR5 considers the Mediterranean Region as "*high vulnerable to climate change*" also mentioning that it "*will suffer multiple stresses and systemic failures due to climate changes*".

A key feature for the climate of the Mediterranean region is the presence of the Mediterranean Sea itself which represents an important source of energy and moisture to the atmosphere. Sea Surface Temperature (SST) anomalies govern, at least in part, air temperature and precipitation anomalies in the surrounding land areas.

Beside the small scale, the Mediterranean climate is influenced by the large scale circulation, connecting the basin with both tropical and mid-latitude climate dynamics. At the same time, there are evidences that the Mediterranean climate variability is statistically linked also to the El Niño Southern Oscillation and the South Asian Monsoon

2.2 Observations and recent trends

The Mediterranean past and recent trends (1951-2005) of seasonal temperature and precipitation was assessed by Ulbrich et al. (2012) who found that winter precipitation in the Mediterranean is characterized by a drying during the past decades. They also identified a strong and statistically significant increase of mean summer temperature. For summer precipitation, large areas, as the Iberian Peninsula and northern Italy and the Alpine areas, reveal a statistically significant decreasing trend.

Consistent with the temperature and precipitation, also the mean sea-level pressure field presents statistically significant trends during the period 1951-2005. In particular, the winter pressure field presents a strong positive trend over the Atlantic and the Mediterranean area. In summer, a weaker but positive trend appears to characterize the whole Mediterranean region. These results highlight a changing atmospheric circulation over the Mediterranean, leading to a northward shift of the Atlantic storm track and an increased stability over the basin.

The Mediterranean SST trends obtained from ocean re-analyses (Adani et al., 2010) are in good agreement with the seasonal air temperature of the surrounding land areas. Increasing SSTs for both seasons are detected in the central and western Mediterranean, with the exception of the Ligurian Sea.

Regarding sea level rise (SLR), according to the recent EEA indicators assessment (EEA, 2014), from 1992 to 2013 some regions of the Mediterranean basin have exhibited increasing trends of more than 6 mm/year, and others showing decreases of more than 4 mm/year in absolute sea level, against a global mean of about 3 mm/year over the last two decades.

The pH of Mediterranean waters has decreased by 0.05 to 0.14 pH since the preindustrial period (Luchetta et al., 2010; Touratier and Goyet, 2011), with the western basin being more contaminated than the eastern basin.

2.3 Climate-related research

Significant progresses has been made on climate projections for the Mediterranean region, both through new models and new simulations. Besides dynamical downscaling by regional climate models, statistical downscaling is a major tool to derive climate change projections at regional or even local scales. For the Mediterranean area, an increasing number of downscaling studies based on different statistical techniques have been published in the last two decades. Climate science and modelling have made great advances over the past years: over a period of 10–15 years the typical resolution of regional climate models has increased from around 100 km to 25–50 km. Higher resolutions, of the order of 2–10 km, are currently being explored and tested in climate projections.

International research initiatives on Mediterranean climate dynamics include the MedCLIVAR project (endorsed by the World Climate Research Programme - WCRP) on climate variability, the MEDEX project (endorsed by the World Meteorological Organization) on high-impact cyclones, the HyMex programme, focusing on the hydrological cycle, and the MedCORDEX framework on regional climate modelling over the Mediterranean domain, contributing to the wider WCRP-sponsored CORDEX program.

Regarding EU-funded initiatives, an assessment of recently observed modifications of the Mediterranean climate and the expected changes for the 21st Century was yielded by the FP6 CIRCE project. Within CIRCE a new set of climate models was developed specifically designed to perform climate simulations and projections with a focus on the Mediterranean region. These models and the simulations performed with them represent a substantial improvement in the representation of the Mediterranean Sea.

The provision of information on regional climate change over the wide Euro-Mediterranean sector was also a major outcome of the EU ENSEMBLES project, through a large ensemble of Regional Climate Model (RCM) simulations performed at a 25 Km horizontal resolution for the transient periods 1951-2050 or 1951-2100.

Additional information, but at a typically much coarser horizontal resolution is provided by the CMIP3 and CMIP5 (Coupled Model Intercomparison Project Phase 3 and 5) multi-model ensembles of long-term simulations, covering preindustrial, historical and scenario radiative forcing conditions.

Altogether, the experiments performed within CIRCE and ENSEMBLES frameworks represent an impressive set of high-resolution regional scale modelling results, allowing a detailed description of the mechanisms driving climatic variability and change over the Mediterranean region.

Several overview works (including project reports, peer-review articles and books) synthesizing the current understanding on climate variability and change for the Mediterranean region, based on both observational and modelling evidence, have been produced in the recent past. Among the most updated and comprehensive reviews we note the CIRCE project report on "*Regional Assessment of the Climate Change in the Mediterranean: Air, Sea and Precipitation and Water*" (Navarra and Tubiana eds., 2013), and the new MedCLIVAR review book "*The climate of the Mediterranean Region: from the past to the future*" (Lionello ed., 2012). Most of the scientific references in this document comes from research mentioned in these volumes.

2.4 Scenarios and projections for the future

Future climate conditions for the Mediterranean Region are analyzed by Dubrovsky et al. (2014) on the basis of on an ensemble of 16 Global Climate Models.

Their results confirm previous findings (Giorgi and Lionello 2008) and show an increase in temperature in all seasons and for all parts of the Mediterranean with good inter-model agreement. Temperature

maxima will increase not only because of an overall rise in mean temperature, but in some areas also because of increases in temperature variability and daily temperature range.

Precipitation is projected to decrease in all parts and all seasons (the most significant percent change occurs in summer) except for the northernmost parts in winter. The reduced summer rainfall is quite a homogeneous feature of the entire basin. During winter, however, the precipitation response appears to be different in the northern part of the Mediterranean area and over the Alps, where some increase of rainfall is found, whereas the rest of the domain characterized by a pronounced tendency to reduced precipitation.

In all of these simulations, the changes in mean seasonal precipitation during northern winter are characterized by a relative small decrease in the whole Mediterranean basin (in the range of -5%), with almost no change in the northern part of the basin and a more visible reduction (in the range of -5%-10%) in the southern part. During summer, all of the climate change projections show marked increase in the near-surface temperature and decrease in precipitation over the entire region.

Further, their results indicate high inter-model agreement on a significant decrease of soil moisture in all seasons, with the most significant decrease occurring in summer.

The CIRCE projections for the 21st century, therefore, suggest that remarkable changes in the climate of the Mediterranean region might occur already in the next few decades, showing a substantially steadily increase of the near-surface temperature that leads the Mediterranean lands to be about 2°C warmer in the 2021-2050 period with respect to the 1961-1990 mean. The change in the simulated near-surface temperature is accompanied by a change in precipitation, with a clear tendency to dryer conditions for the Mediterranean area during both seasons and some tendency to increased winter precipitation over the Alpine region. These findings lead to suppose a more general alteration of the hydrologic cycle for the whole Mediterranean area.

In general, climate change projections show an increase in the number of very hot days and nights as well as longer warms spells and heat waves, with the largest increases over the Iberian Peninsula in summer. The very cold days and nights, on the other hand, exhibit a significant decrease and cold spells appear to be shorter. The projections indicate also an earlier onset and a longer duration of droughts.

Change in precipitation regimes results in an increase of heavy daily precipitation in winter over the Iberian Peninsula (except for the south), southern Italy and the Aegean area and a weak general increase in the percentage of winter precipitation in association with strong daily precipitation events. The number of the days with heavy precipitation decreases over the western and central part of the Mediterranean region, whereas they seem to increase over the northeastern part. In general, there is an increase in the intensity of heavy precipitation events over most of the Mediterranean region in all seasons.

A general decrease is found in the density of cyclone tracks. Moreover, a general decrease is found also in the frequency of cyclones associated with extreme winds, whereas no significant change is visible in the intensity of the most extreme windstorms. Finally, concerning the extreme oceanic conditions, no substantial change is found in extreme sea level values, whereas there are suggestions of a possible general reduction of the extreme significant wave height.

As for projections of future changes in the level of the Mediterranean, the IPCC reports projections of SLR in the range of 0.1–0.3 m by 2050 and of 0.1–0.9 m by 2100, with major impacts on the southern Mediterranean region (IPCC, 2013). The simulations conducted by the project CIRCE (Navarra and Tubiana, 2013 a) based on the –previous generation- A1B IPCC emission scenarios, predict an increase in the mean steric sea level rise between around 0.07-0.12 m in the period 2021-2050 with respect to the reference period (1961-1990).

It is important to note that the steric contribution is only one of the components that might influence the sea level change in the Mediterranean Sea. There are other components that might determine the sea level trends in the basin, such as the melting of the continental ice sheets (Greenland and Antarctica) that, especially on the long term (centennial time scales), might become dominant.

It should also be noted that in the case of SLR in the Mediterranean, scientific uncertainty is particularly high, as making multi-decadal regional projections for relatively small isolated and semi-isolated basins such as the Mediterranean is more complex than for the global ocean (EEA, 2014). Nevertheless, the effect of SLR is considerable in most low-lying coasts of the Mediterranean basin where communities and infrastructure are typically located. In addition to the seawater expansion due to steric effect, coastal subsidence and global ocean level increase induced by continental glaciers melting (in Greenland and West Antartica) have to be considered as SLR components for the Mediterranean.

CIRCE Project - Summary of model climate change projections over the Mediterranean region:

- In the course of the 21st century the Mediterranean region might experience a substantial warming, which in summer might be of the order of 0.6°C/decade.
- The warming appears to be accompanied by a reduction in precipitation (projected annual mean precipitation in the 2021-2050 period decreases by about 5% compared with the mean for the 1961-1990 period) over the entire region, more pronounced in the southern and western part of the basin, during summer.
- Interannual variability of temperature and precipitation in the Mediterranean basin is projected to generally increase, especially in summer, as is the occurrence of extreme heat and drought events.
- The sea level of the Mediterranean Sea might increase causing adverse impacts on the coastal areas. The projected mean sea level rise in the period 2021-2050 due to the sole steric effect (i.e. the change due to thermal expansion and salinity-density compensation of sea water) might be in the range of about +6 / +11 cm.
- There is an expected increase in the number of very hot days and nights as well as longer heat waves. The projections indicate also an earlier onset and a longer duration of droughts.
- Overall, there is an increase in the intensity of heavy precipitation events over most of the Mediterranean region in all seasons.
- A general decrease is found in the density of cyclone tracks. Moreover, a general decrease is found also in the frequency of cyclones associated with extreme winds, whereas no significant change is visible in the intensity of the most extreme windstorms.
- These results appear to be reasonably robust in that they are present in most projections from both global and regional models, and are consistent across emission scenarios and future time slices.

The following graphs are extracted from Annex I (Atlas of Global and Regional Climate Projections) of the Report of WGII in the IPCC AR5, which presents a series of figures showing for the 26 sub-continental regions identified in the SREX report, regional patterns of climate change computed from global climate model output gathered as part of the Coupled Model Intercomparison Project Phase 5 (CMIP5).

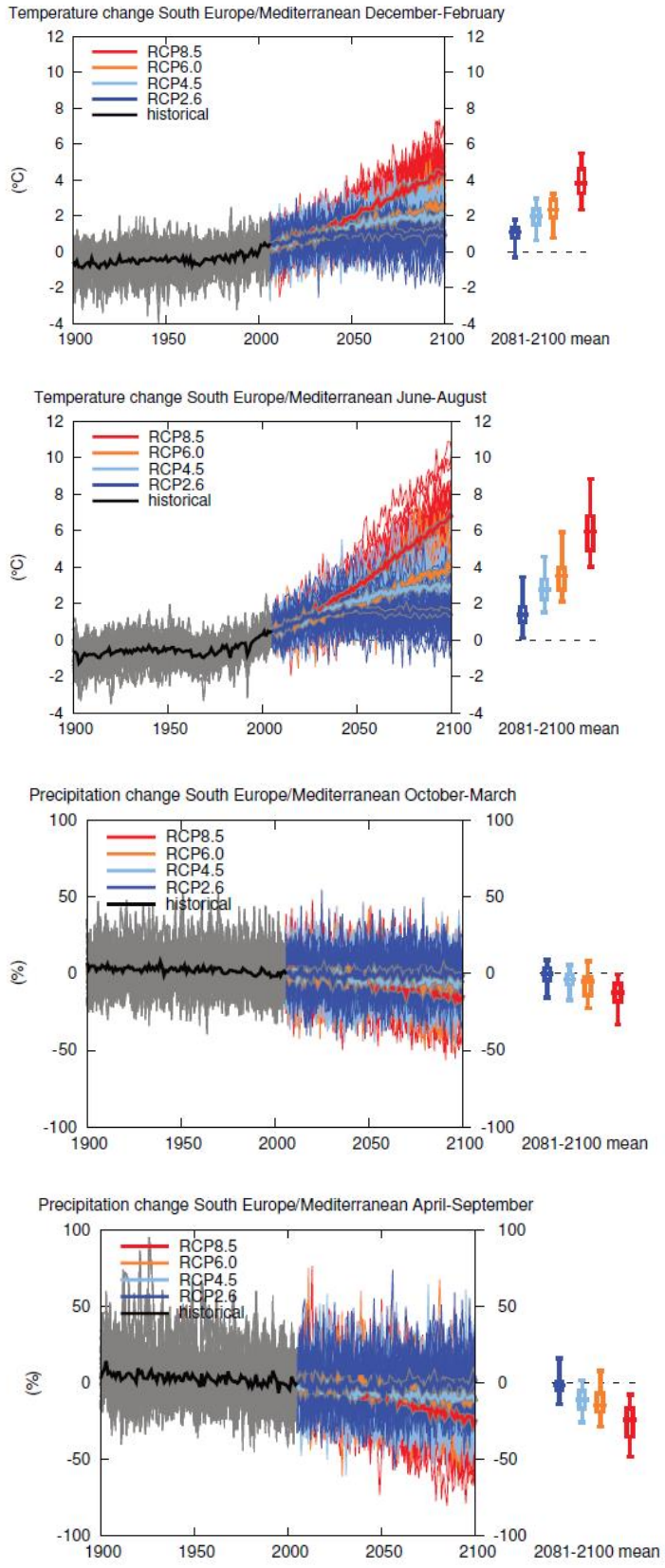

Figure 2: Time series for land and sea average temperature in the Mediterranean, under IPCC's Representative Concentration Pathway (RCP) scenarios. Source: IPCC, 2013: Annex I: Atlas of Global and Regional Climate Projections

The following table includes information on observed and projected regional changes in temperature and precipitation extremes, including dryness for the Mediterranean, extracted from Tables 3-2 and 3-3 of the SREX report. Projections are for the end of the 21st century versus the end of the 20th century and for the A2/A1B emissions scenarios.

	Trends in maximum temperatures	**Trends in minimum temperatures**	**Trends in heat waves / warm spells**	**Trends in heavy precipitation**	**Trends in dryness and drought**
Observed	Likely increase in warm days and likely decrease in cold days in most of the region. Likely strongest and most significant trends in the Iberian Peninsula and southern France	Likely increase in warm nights and likely decrease in cold nights in most of the region; likely strongest signals in Spain and southern France	Likely overall increase in heatwaves in summer. Significant increase in max heatwave duration in Iberian Peninsula, in Tuscany and in Turkey	Inconsistent trends within domain and across studies	Inconsistent trends within domain and across studies
Projected	Very likely increase in frequency and intensity of warm days and decrease in cold days. Number of days with combined hot summer days (>35°C) and tropical nights (>20°C) very likely to increase.	Cold nights very likely to decrease. Warm nights very likely to increase. Tropical nights very likely to increase. Number of days with combined hot summer days (>35°C) and tropical nights (>20°C) very likely to increase.	Likely more frequent and/or longer heat waves and warm spells (also increases in intensity); likely largest increases in S.W., S., and E.	Inconsistent change in heavy precipitation intensity, depends on region and season; increase in heavy precipitation intensity in all seasons except summer over parts of the region, but decrease in other parts, e.g., Iberian Peninsula.	Increase in dryness in Mediterranean. Consistent increase in area of drought.

Table 2: Observed and projected regional changes in temperature and precipitation extremes, including dryness for the Mediterranean. Adapted from: IPCC, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

2.5 Observation networks

The countries of the Mediterranean have national observation and monitoring systems of varying data quality and availability, with northern countries enjoying more long-term and high-quality climate data than southern ones. Nevertheless, monitoring systems related to marine ecosystems (biotic and abiotic components) in the coastal and open waters are still lacking. Infrastructure, spatial coverage and data issues at the national level are challenges that need to be addressed. Crucial coordination issues, however, are also essential to be addressed at the regional level.

Mediterranean countries participate, to a different extent in the Global Climate Observing System (GCOS) international monitoring programme as well as the following regional initiatives:

- Monitoring Network System for Systematic Sea Level Measurements in the Mediterranean and Black Sea (MedGLOSS);
- Mediterranean Operational Oceanography Network (MOON);
- Mediterranean Global Ocean Observing System (MedGOOS);
- Mediterranean Hydrological Cycle Observing System (MED-HYCOS).

EU member countries participate also in the Global Monitoring for Environment and Security (GMES) European Earth Observation Programme.

In the European Union, Copernicus is the flagship programme on monitoring the Earth's environment using satellite and in-situ observations. Copernicus' Climate Change Service aims to combine observations of the climate system with the latest science to develop information about the past, current and future states of the climate in Europe and worldwide.

The T-MedNet network develops temperature systematic monitoring tools and protocols to study the effects of climate change on coastal populations. It is devoted to spread the acquisition of long term high resolution temperature series in Mediterranean coastal waters (0-40 m) as well as to facilitate data sharing and analysis.

MyOcean2 is a monitoring service at European and National levels with long time-series of in-situ (physical and biochemical) and remote sensing (ocean colour and SST) products. Among the parameters measured is temperature, salinity, currents, sea level, chlorophyl-a, dissolved oxygen, nutrient and light penetration.

The HYDROCHANGES network is a Mediterranean network of autonomous conductivity, temperature, and depth sensors, deployed on mainly short and easily manageable subsurface moorings, for long-term monitoring of basic hydrological parameters (temperature and salinity),

Finally, it is worth noting that the Twelfth World Meteorological Congress (1995) adopted Resolution 40[1] "WMO Policy and Practice for the Exchange of Meteorological and Related data and products including Guidelines on Relationships in Commercial Meteorological Activities" to facilitate worldwide co-operation in the establishment of observing networks and to promote the exchange of meteorological and related information in the interest of all nations.

[1] https://www.wmo.int/pages/about/Resolution40_en.html

3 OVERVIEW OF RISKS AND VULNERABILITIES

While determining tendencies and changes in the climatic system is quite delicate due to the multitude of factors that must be taken into account, the complexity of trying to identify the possible impacts of climate change is even greater, especially when considering uncertainties on regional and sub-regional trends. Indeed, these impacts are the result of confrontation between the major trends of climatic parameters and the specific conditions of the affected area, in other words the natural and manmade characteristics of the Mediterranean zone.

As the IPCC AR5 puts it "*Increasing magnitudes of warming increase the likelihood of severe, pervasive, and irreversible impacts. […] Global climate change risks are high to very high with global mean temperature increase of 4°C or more above preindustrial levels in all reasons for concern, and include severe and widespread impacts on unique and threatened systems, substantial species extinction, large risks to global and regional food security, and the combination of high temperature and humidity compromising normal human activities, including growing food or working outdoors in some areas for parts of the year. The precise levels of climate change sufficient to trigger tipping points (thresholds for abrupt and irreversible change) remain uncertain, but the risk associated with crossing multiple tipping points in the earth system or in interlinked human and natural systems increases with rising temperature."*

Mitigation of climate change is beyond the scope of this report, but it is crucial to note that the overall risks of climate change impacts can be reduced by limiting the rate and magnitude of climate change, that reducing climate change can also reduce the scale of adaptation that might be required, but also that even under the most ambitious mitigation scenarios, some risk from adverse impacts remains.

It is also crucial to note that the Mediterranean is already characterised by natural environments and resources that are already under high pressure from non-climate drivers, such as urbanization, coast-ward migration of people, tourism, intensive irrigated agriculture, dam building, industries, and port facilities and that climate-induced drivers are likely to increasingly aggravate the existing problems and to create new risks.

The aim of this section is to put forward here a very brief overview of the impact types (with a special focus on a few key sectors) that can be foreseen. Section 3.3 includes a more detailed discussion on expected impacts at the national scale, as they have been identified in official country reports and strategies. The structure of this section follows the categorization of systems and sectors used in the "*Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*" Contribution of Working Group II to the IPCC AR5.

3.1 Natural and managed resources and systems

3.1.1 Freshwater resources

The most critical impacts of climatic changes in the Mediterranean region are likely associated with the water availability. The whole region is already vulnerable to water scarcity and drought, in particular the South and East countries, while even in countries in the North, a growing percentage of water production is non-sustainable, leading to an over-exploitation of groundwater resources. A very critical situation under climate change in the region, with a reduction in precipitation and structural water shortages, is expected to affect 60 million people already from 2025 (Lionello et al. 2006). Another characteristic of water resources in the Mediterranean is their irregular geographic distribution: 71% are located in the North, 9% in the South and 20% in the Near East.

The changes of climate patterns will result in various physical impacts on water resources, since water is involved in all components of the climate system, and affects different aspects of human well-being from agricultural productivity and irrigation supply to flood and drought control, municipal and industrial water supply, ecosystem's protection and energy use.

Most countries on the Southern and Eastern shores of the Mediterranean are already considered as facing chronic scarcity of water resources and the situation is expected to worsen in the future under the combined effect of increased demand for water and the projected impacts of climate change which include declines in average rainfall and in total runoff, and depletion of groundwater resources. Coastal aquifers would become threatened by salinization due to rising sea levels and by overexploitation which declines their resilience to saline intrusion.

Moreover, despite a decrease in average precipitation, models foresee in the Mediterranean summers characterised by an increase in frequency of extreme daily precipitation. This tendency can lead to longer dry periods, interrupted by extreme intense precipitation, enhancing the risk of floods. The JRC PESETA II Project "Climate Impacts in Europe", estimates that even in the 2ºC scenario direct economic damages from river flooding in Southern Europe will increase from 0,67 to 1,19 billion euros per year in the 2080s.

The rapidly growing non-agricultural water needs of many countries in the area can generally not be met by further exploitation of water resources except through either the development of expensive desalination facilities or the reallocation of water resources from agriculture. This could bring major social and political change and risk exacerbating existing inequalities and regional tensions.

3.1.2 Terrestrial systems

Although the scope of the Regional Climate Change Adaptation Framework is on the marine and coastal areas of the Mediterranean, this report would be incomplete without mentioning the increased risk of fires in terrestrial coastal ecosystems that Mediterranean countries, especially in the North, as a result of climate change.

The factors that are driving forest fires are both socioeconomic (eg changes in land use) and climate-related. Looking into the future, the Mediterranean is expected to continue to experience significant changes both in climate and in socioeconomics. Therefore, understanding and attributing fire activity and the factors that affect it, may require additional research.

It is clear however that higher temperatures, increasing heatwaves in combination with reduced rainfall and more severe droughts, are expected to lead to increased mean fire-weather indices and length of the fire season, including areas in which fires were not prevalent until now.

Recently, the FUME project ("*Forest fires under climate, social and economic changes in Europe, the Mediterranean and other fire-affected areas of the world*") using appropriate mathematical procedures to relate climate and fires, while controlling for the possible interference of other factors in this relationship, a significant and positive relationship was revealed between climate and fires during the last three decades for the various Mediterranean regions in southern Europe. This occurred despite the fact that, in recent years, fires (numbers, area burned) were decreasing while fire weather danger was increasing.

The JRC PESETA II Project "Climate Impacts in Europe", estimates that even in the 2ºC scenario average annual burnt area from forest fires in Southern Europe will increase from 361 to 526 thousand hectares per year in the 2080s.

3.1.3 Coastal systems and low-lying areas

Coastal zones, arguably the most appealing assets of the Mediterranean, are already exposed to significant pressures from land-based and marine pollution, urban development, fishing, aquaculture, tourism, damming, extraction of materials, and marine biological invasions. Climate change, and especially the major driver of sea level rise, is expected to significantly increase these pressures. In particular, many coastal systems will experience increased inundations and storm flooding, accelerated coastal erosion, seawater contamination of fresh groundwater, displacement of coastal lowlands and wetlands, encroachment of tidal waters into estuaries and river systems, possible loss of nesting beaches. More frequent and severe weather and climatic events will further enhance these phenomena, while in the longer term, changes in wind and wave patterns could interfere with sediment transport leading to greater erosion or accretion.

Coastal erosion will lead over time to the inland migration of the beaches of the Mediterranean with soft sedimentary coasts being more vulnerable than harder, rocky coastlines. River deltas, due to their particular topography, are particularly vulnerable to the impacts of erosion and inundation. Damming of rivers upstream no longer allows the normal circulation of sediment, which cannot reach the delta to consolidate it.

At the local scale, possible impacts from sea level rise are also determined by other non-climatic factors such as the subsidence of coastal land, subsurface resource extraction, and tectonic movements.

The JRC PESETA II Project "Climate Impacts in Europe", estimates that even in the 2^{o}C scenario the average annual costs from sea floods damage in Southern Europe will increase from 163 to 903 million in the 2080s.

3.1.4 Ocean systems

The Mediterranean Sea is among the richest in biodiversity of global importance, rich with endemism and autochthonous species. At the same time, it has unique marine features that make this region particularly vulnerable to climate change. The overall extent of water exchange is restricted due to the narrow connections with the Atlantic Ocean, the Red Sea and the Black Sea. In addition, due to the relatively small size of the basin, seawater in the Mediterranean can more easily heat up and evaporate, combined with hot, dry summers and low inflow from rivers.

Increases in sea temperatures will alter distribution of species and foster the spread of warm water species into the Mediterranean, thus promoting the displacement of ecotypes and shifts in ecosystem functioning and ultimately lead to loss of species. The IPCC AR5 identified the Mediterranean Sea as one of the semi-enclosed seas with projected high rates of local extinction because land boundaries will make it difficult for species to move laterally to escape waters that may be too warm. Additionally, periods of extreme seawater temperature during heatwaves will contribute to mortality events that affect many invertebrate species as well as Posidonia meadows.

Another emerging climate-related threat to Mediterranean marine ecosystems, is ocean acidification, the phenomenon of shifting the chemical balance of seawater to a more acidic state (lower pH) due to increased CO2 concentrations in the sea as a result of increased CO2 concentrations in the atmosphere. Acidification is currently occurring at a geologically unprecedented rate, subjecting marine organisms to additional environmental stresses. According to the MedSEA project[2], the acidity of Northwestern

[2] MedSEA was an FP7 project running from 2011-2014, involving 12 nations with 18 institutes from the Mediterranean region, and aiming to identify the impacts of acidification on Mediterranean waters, to generate new data on Mediterranean organism and ecosystem responses to acidification, and to provide best estimates and related uncertainties of future changes in Mediterranean Sea biogeochemical-ecosystem variables. http://medsea-project.eu/

Mediterranean seawater has increased by 10% since 1995 and if current CO2 emission rates continue, it will increase another 30% by 2050 and 150% by 2100. Several planktonic organisms are affected by acidification with possible negative impacts on fish populations. Moreover, acidification also threatens iconic and invaluable Mediterranean ecosystem-building species (such as sea grass meadows, Coralligene reefs and Vermetid snail reefs) which create rich key habitats and homes to thousands of species, and also protect shores from erosion as well as offer a source of food and natural products to society.

More specifically, the following Mediterranean ecosystem types will be affected by climate change: [source: MedPAN 2012]

Coralligenous formations: Sea warming and exposure to high temperatures may affect coralligenous formations both directly, by causing harmful metabolic changes and physiological stress, and indirectly by reducing their resistance to pathogens. Heatwave events involving a 3–4 °C increase in seawater temperature can induce mass-mortality events in some gorgonian or sponge communities. Coralligenous species with calcareous skeletons can be affected by increased seawater acidification, which both reduces skeletal growth and tends to dissolve their skeletons. As most of these species are characterized by high longevity and slow growth, a dramatic increase in mortality could have severe consequences in terms of population viability, and consequently could affect the structure and function of coralligenous formations as habitat-forming assemblages in the marine ecosystem.

Coastal fish populations: Climate change is expected to force fish species distributions toward the northern areas of the Mediterranean, especially for coastal fishes. Species typical of the southern parts of the Mediterranean, are now spreading northward into the coldest parts of the Mediterranean as a result of rapid warming. Other thermophilic fishes have increased in abundance with the rise in water temperature. Conversely, cold-water species are contracting their distribution ranges as a consequence of warming and, in the worst-case scenario they could eventually face extinction. The warming of the Mediterranean also seems to underlie the increasing success of the sea's non-indigenous biota and the changing migratory habits of certain fish species.

Coastal benthic assemblages: Sea level rise can directly affect endemic and habitat forming benthic species as they are highly vulnerable to water level changes and physical erosion along the shoreline. Sea acidification can also affect vermetid calcification and have detrimental effects on its growth rate, resulting in local extinction events. Additionally, the spreading of non-indigenous species which outperform native ones, can drive deep modifications in coastal benthic assemblages, eg through grazing large areas of algal beds, reducing important nursery areas for other juvenile fishes and changing local algal communities.

Jellyfish: Recent evidence indicates that moderate sea warming (0.5–1 °C) may have the potential to trigger abrupt increases in abundance (known as blooms or outbreaks) of some planktonic organisms, including jellyfish and harmful algal species. Reduced freshwater inflow from rivers, due to the decrease in summer rainfall, also favour jellyfish blooms.

Seagrasses and macroalgae: Posidonia oceanica is highly sensitive to seawater warming, and high mortality rates may be expected in natural populations under severe temperature increases. The regression of Posidonia oceanica meadows may give a competitive advantage to other species, particularly those with warm-water affinities, and may favour the proliferation of competing algae, in particular invasive macroalgae of tropical and subtropical origin. Together with other sources of disturbance, severe storms can reduce the resilience of macroalgal forests, affecting the survival of new settlers and making their natural recovery slow or even implausible. A shift from structurally complex benthic habitats to low-diversity habitats dominated by ephemeral seaweeds is the ultimate consequence of these declines. The resilience of these formations and their potential restoration will further depend on the multiple stressors on the local environment.

3.1.5 Food security and food production systems

Agriculture absorbs over 80% and 60% of total water demand in the African and European countries surrounding the Mediterranean Sea, respectively. The general decrease in soil moisture and water availability in general, and the increase in the frequency and intensity of droughts as a result of climate change in the Mediterranean will increase the existing water-related stresses and have strong negative effects on crops and agriculture in general. The increased need for irrigation will be constrained by reduced runoff, reduced recharge of aquifers, and competition from other sectors, in particular human settlements and energy.

Beyond the availability of water resources, agricultural production in the Mediterranean will be affected by temperature increases. A large negative sensitivity of crop yields to extreme daytime temperatures around 30°C has been documented by numerous studies, characteristically for wheat in the Mediterranean. A warmer and drier climate is projected to shift vegetation and agricultural zones northward e.g., by 75 km for 2090–2099 relative to 2000–2009 in a 4°C world in Middle East and North Africa (World Bank, 2014).

Additional pressures, considering the region's very long coastline, will occur due to soil loss due to coastal erosion and sea water intrusion in costal aquifers due to sea level rise. Additionally, the impact of agricultural fertilizers will be greater under climate change: higher concentrations of nitrates in warmer receiving watercourses will lead to adverse impacts on water quality.

Moreover, food quality could be affected by climate change. Studies have shown that growing wheat, rice, barley or potato in high CO2 concentrations reduces the protein content by 10–14%, while some crops may also show reduced mineral and micronutrient concentrations. Furthermore, some pest outbreaks are attributed to climate change. Rising temperatures and changes in precipitation patterns, undermine the natural regulation of pests and diseases, while increasing the ranges of various pests.

Regarding the quantification of possible impacts of climate change to the agricultural sector, the IPCC AR5 WG2 Report, under future scenarios, projects yield impacts for wheat, maize and soybean of -22% to 0% in the North of the Mediterranean and -27% to +5% in the South. The World Bank's "Turn down the heat" report estimates that crop yields in Middle East and North Africa will eventually decline by 30% in the 1.5–2°C warming scenario and up to 60% in the 3–4°C one. Legumes and maize crops are expected to be worst affected in both areas as they are grown during the summer period. The JRC PESETA II Project "Climate Impacts in Europe", estimates that even in the 2ºC scenario, in Southern Europe the average agriculture yields will decrease by 18% and the cropland are affected by drought will increase by 1400%

Livestock production in the Mediterranean region will also be affected by climate change through various pathways, including changes in the quantity and quality of available feeds, changes in the length of the grazing season, additional heat stress, reduced drinking water availability and changes in livestock diseases and disease vectors.

Fish diversity and fishing catches in the Mediterranean are already vulnerable as fisheries are already overfished or fully exploited. As a result of climate change they will be further affected due to increases in salinity and seawater temperatures that will induce migration towards higher latitudes or deeper waters, and due to the spread of invasive species which may outcompeted or replace native ones. As a result, species that are commercially important in some areas may no longer be available in the near future and markets may have to explore other target species rather than those currently sold. Climate change can also influence where aquaculture is possible, which species are raised, and the efficiency of the production.

3.2 Human Settlements, Industry, and Infrastructure

3.2.1 Urban areas

More than a third of the population of Mediterranean countries live in coastal zones. This is more evident in Northern African and Middle Eastern countries where coastal cities have traditionally been particularly important due to the aridity of inland regions.

As coastal populations and assets in coastal areas continue to grow, exposure to climate change-related hazards –and especially those associated with sea-level rise- is also increasing. What is especially worrying is the rapid growth of highly vulnerable urban communities living in informal settlements, many of which are on land at high risk from extreme weather and often lack essential infrastructure and services or there is inadequate provision for adaptation.

The key expected impacts of climate change in coastal urban areas include

- Inland flooding, especially threatening settlements with inadequate infrastructure on flood plains or along river banks
- Coastal flooding and storm surges in low-lying and unprotected coastal zones
- Heatwaves, exacerbated by the urban heat island effect, with vulnerability higher among urban populations of infants, older age groups, expectant mothers, people with chronic diseases.
- Wind storms with higher intensity and other extreme events threatening substandard buildings and infrastructure
- Water shortages and drought especially in settlements lacking piped water
- Enhanced air pollution due to changes in urban meteorological regimes
- Other geo-hydrological hazards, such as salt water intrusion and landslides

Several coastal cities in North African and Middle Eastern countries are highly exposed to such hazards and especially sea-level rise, due to their low-lying topographies.

A recent study (Dasgupta et al. 2009) has found that in terms of the percentage of urban area lost to one meter of sea-level rise, highly vulnerable countries are Egypt (5.5%), Libya (5.4%), and Tunisia (4.5%). They also estimated that Egypt and Tunisia have 9.3% and 4.9% of their population respectively exposed to a 1-meter sea-level rise. One other study (Brown et al. 2011) suggested that, in the absence of adaptation, 1.97 million people in Egypt could be affected by a sea-level rise of 0.54m and 1.82 million people in Morocco could be affected by a sea-level rise of 0.44 m with 2.6°C global warming compared to 1990 levels. Another study (Hinkel et al. 2012) identified Egypt, Tunisia, Morocco, and Libya as among the most vulnerable African countries in terms of total population affected by sea-level rise under scenarios of 0.42–1.26 meters in sea-level rise by 2100, assuming no adaptation.

3.2.2 Key economic sectors & services

Tourism

The Mediterranean is the world's most popular touristic destination with about half of the region's tourists visiting its coastal zones. Climate change is expected to have a wide range of negative consequences for tourism in the region, including heat waves, spread of diseases, drought, the associated risk of fires, explosions in organisms such as algae and jellyfish. Sea level rise and coastal erosion will lead to loss of beaches and other natural attractions, as well as of infrastructure relevant to tourism activities. In general climatic conditions for outdoor tourist activities are expected to deteriorate in summer.

As a result, an increased variation of the distribution of tourists, rather than the volume of tourism should be expected. It is likely that climate change will cause a shift in the choice of tourist destinations towards greater latitudes and altitudes. Also, the occurrence of a shift in the tourism season is likely, with an

increase in the influx of tourists to the coast in the months when the air and water temperature will not be too hot, thus shifting from the hot summer months to the spring and autumn months.

However, there is considerable uncertainty about how tourists will respond to the effects of climate change and therefore overall vulnerability of coastal tourism is hard to assess.

Transportation

Port infrastructure, but also coastal roads, railways, and airports, are expected to be at risk mainly due to temporary and permanent flooding arising from sea-level rise, high winds and storm surges. Negative impacts are also expected from large waves generated by storm surges and floods/landslides especially in the Northern Adriatic (Lionello et al., 2012). These phenomena are likely to cause damage to infrastructure, interruptions and bottlenecks in the flow of products through ports. In general, port infrastructure will experience disruption of "just in time" delivery of goods; welfare losses; increased cost for reparation and maintenance. Increasing wind speeds present numerous challenges to the berthing of ships, and the operation of harbor equipment. Changes in water temperature and water quality can lead to invasive species causing damage to wooden structures, and the fouling of ships and harbor facilities.

Road and rail transport networks located on the coast can be negatively affected by sea level rise (and sea storms) causing increased risks of inundation and erosion, leading to disruptions in the transport of goods and in the mobility of local communities. Moreover, increased inspections and repairs may become necessary due to erosion of transport structures caused by inundation and saline intrusion.

Energy

Climate change impacts are projected to also affect energy systems, especially thermal and hydro electricity production, distribution infrastructure, as well as electricity demand.

Thermal power plants can face risks due to increased air temperatures that reduce thermal conversion efficiency and to decreased water availability (and increased temperatures) necessary for the cooling of the plants. Extreme weather events may affect not only power plants but also the transmission and distribution systems and their overall reliability potentially leading to power outages. The projected overall decrease in precipitation and river runoff and/or increased seasonality due to climate change, will also affect hydropower generation.

Energy demand for heating and cooling will be strongly by affected by climate change as a result of increasing temperatures, with decreasing demand for heating and increasing for cooling respectively. The JRC PESETA II Project "Climate Impacts in Europe", estimates that in the Reference (business-as-usual) scenario, while energy demand in the EU as a whole will decrease by 13% by 2080, in Southern Europe it will increase by 8%.

3.3 Human Health, Well-Being, and Security

3.3.1 Human health

The main driver of climate-related direct effects on human health is heat-related mortality and morbidity (due to cardiovascular and respiratory causes) and additional heat stress during heatwaves, as well as deaths and injuries due to extreme weather events. Observations in various Mediterranean countries mentioned in (Navarra et al 2013) showed that the percentage increase of mortality associated with 1 degree increase of apparent temperature ranged from 0.1% to 8.0%. Concerning heatwaves, the increase

in mortality is high: total deaths from natural causes increased by 14%, deaths from cardiovascular problems by 22% and respiratory problems by 32% during heatwaves events. According to recent studies (Giannakopoulos et al. 2013), for 2040–2069 and under the SRES A1B warming scenario, the number of days characterized by high thermal discomfort in North Africa is projected to increase by approximately 35 days, from approximately 100 days in the base period of 1961–1990. The JRC PESETA II Project "Climate Impacts in Europe", estimates that even in the 2ºC scenario, the impact of heat-related events will lead to 65% additional deaths (14,000) per year in Southern Europe by 2080.

Additionally, climate change is expected to affect public health via changes in biological and ecological processes that influence the transmission of several infectious diseases. Countries in North Africa and Middle East are experiencing a resurgence of several vector-borne and viral diseases that had previously been in decline. Scientific evidence indicates that changes in climatic factors can affect the incidence of vector-borne diseases in the MENA region such as malaria, leishmaniasis and schistosomiasis. The prevalence of food-borne diseases such as salmonella and Escherichia coli, and water-borne diseases such as cholera, dysentery, and typhoid fever, is expected to be affected by changing temperature and rainfall patterns in the region.

3.3.2 Human security

Climate change could act as a threat multiplier in the Mediterranean region, predominantly in countries outside of the EU, by placing additional pressure on already scarce resources (especially water and land), reinforcing preexisting threats as political instability, poverty, and unemployment, and overstretching societies' adaptive capacities. However, currently there exists no scientific consensus on the primary causes, mechanisms, links, and interventions between climate change and conflicts and insecurity (Gemenne et al. 2014).

Similarly, it is difficult to say whether migration in the region is driven by climate changes or is economically, socially, or politically motivated. This indicates that climate-induced migration should be addressed not only within the framework of climate change, but also within other economic, cultural, technological or political conditions that might foster or limit migration.

3.4 Regional index-based Risk Assessment

In the context of the GEF-funded "*Integration of climatic variability and change into national strategies to implement the ICZM protocol in the Mediterranean*" (ClimVar & ICZM) Project, Acclimatise and its associates prepared the "*Application of a Multi-Scale Coastal Risk Index at Regional and Local Scale in the Mediterranean"* report (Satta, Venturini et al 2015). This section provides an overview of the study's methodology and results.

The core task of the study was to develop and implement an integrated methodology to assess risk and vulnerability to physical and socio-economic impacts of climate variability and change in the Mediterranean with the aim of identifying coastal hot-spots.

Initially an analysis was undertaken to evaluate existing methodologies and tools to assess vulnerability and risk to the impacts of climate variability and change at regional, sub-regional and local level.

Tools typically cover four main categories:

1. Methods based on dynamic computer models.
2. Visualization tools.
3. Index/Indicators based methods.
4. GIS-Based Decision Support Tools.

Available tools were assessed by applying an expert judgment against the following criteria:

- Format, accessibility and ease of use.

- Relevance to the Mediterranean coastal areas.
- Based on ICZM approach.
- Relevance for building adaptation options.
- Economic/costing information.
- Multi-scale approach.

According to the assessment, the Multi-scale Climate Variability Index (CVI) tool, based on the work of McLaughlin and Cooper (2010), was deemed to be the method that best fits the purpose.

An Index-based method is one of the most commonly used and straightforward methods to assess coastal vulnerability and risk to climate driven impacts. The Index provides a simple numerical basis for ranking sections of coastline in terms of their potential for change that can be used by managers to identify regions where risks may be relatively high.

For the purpose of this study, a spatial risk index CRI-MED was specifically developed and derived though a multiplicative formula of sub-indexes of the three determinant factors :

Risk = Forcing x Vulnerability x Exposure

The Vulnerability Sub-Index is characterised by 4 variables:

1. Landform
2. Elevation
3. Population Over 65
4. Education Level.

Landform and Elevation describe the susceptibility of the coast to be affected by inundation, erosion and flooding, the most important coastal hazards occurring in the Mediterranean costal zones. It has also been shown that age of population and education level represent two crucial indicators to estimate the resilience of coastal communities to cope with the adverse effects of coastal hazards.

The Forcing Sub-Index is characterised by 5 variables:

1. Population growth
2. Tourism arrivals
3. Sea Level Rise
4. Storms (Significant Wave Height)
5. Drought

It needs to be noted that this study focused on climate forcings that have direct physical impacts on coastal systems and did not consider other forcings like SST and Ocean acidity.

The Exposure Sub-Index is characterised by 2 variables:

1. Land Cover
2. Population density.

Land Cover indicates the coastal assets at risk, with the highest value being attributed to “urban areas”,

For every segment of the coast under study, each of the above variables takes values from 1-5 according to which of the 5 different “variable classes” they belong to. For example, in the “elevation” variable, areas with elevation <2m (very high vulnerability to SLR) take a value of 5, while those with elevation >30m (very low vulnerability to SLR) take a value of 1.

The selected variables contribute in different ways to the hazards affecting Mediterranean coastal zones, therefore relative weights (through expert judgement) are assigned to them.

The final score for the CRI-MED index with weighted variables is still calculated multiplying the three sub-index values:

CRI-MED = CV x CF x CE

The application of the CRI-MED methodology to the eleven Mediterranean countries selected for the project ClimVar & ICZM led to a ranking of the relative risk of each coastal region in relation to potential coastal hazards (coastal erosion, coastal flooding and saltwater intrusion).

The distribution of coastal segments to the 5 risk classes is shown in the following table and map:

Risk class	CRI Score	Number of cells	% of the total
Extremely High	0,55 - 0,79	3.283	6%
High	0,4 - 0,55	4.772	9%
Moderate	0,27 - 0,4	10.941	21%
Low	0,15 - 0,27	16.542	32%
Extremely Low	0,02 - 0,15	16.812	32%

Table 3: Distribution of risk classes

Figure 3: Mediterranean coastal risk map

The national "coastal hot-spots" that were identified through this study are:

Morocco: Tetouan, Nador and Saidia
Algeria: Ain El Bia, Tenes, Zeralda, Tassoust and Annaba
Lybia: Tripoli, Misrata, Benghazi, Darianah, Tocra and Ad Dirsiyah,
Egypt: Sidi Barrani, Marsa MAtrouth, Alexandria, Baltim, Ras El Bar, Port Said, Al Arish
Palestine: the Northern shore of Gaza Strip
Syria: the shore from Al Hamidiyah to Tartus, the shore from Tartus to Marqueh, Baniyas, the shore from Jable to Latakia, Om Al Toyour and Ummetli

Given its relatively ease of use, the proposed risk assessment method has a great potential to be chosen by stakeholders and decision-makers as a powerful support tool to consider and integrate climate

change-related issues in planning for sustainable adaptation and ICZM strategies on their national coastal territory.

4 CURRENT ADAPTATION EFFORTS IN THE REGION

4.1 Processes under the UNFCCC

Although the UNFCCC historically has placed greater emphasis on climate mitigation than on adaptation, a number of the Convention's provisions relate directly or indirectly to climate adaptation.

Article 2 notes that climate stabilization "should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."

Article 4 establishes both common and differentiated commitments related to adaptation. Article 4.1 commits all parties to "formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing…measures to facilitate adequate adaptation to climate change," and to "cooperate in preparing for adaptation to the impacts of climate change." Article 4.4 commits Annex II parties (a subset of developed countries) to "assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects."

In the years since the Convention's adoption in 1992, parties have strengthened its adaptation focus through a series of decisions and work programs. These have established institutions and mechanisms geared primarily toward providing support for adaptation in developing countries.

A summary of major elements of the existing adaptation infrastructure within the UNFCCC process is outlined below.

The *Cancun Adaptation Framework (CAF)* was adopted in 2010 to bring greater coherence to adaptation-related activities under the Convention and to strengthen support for Least Developed Countries (LDCs). The CAF established a process to help developing countries advance beyond National Adaptation Programmes of Action (NAPAs) by developing and implementing National Adaptation Plans (NAPs). These plans are geared toward identifying medium- to long-term adaptation needs, and developing and implementing strategies and programs to address them. In 2011, the COP encouraged all parties to undertake NAPs, and the NAP process was launched in 2013.

COP 11 launched the *Nairobi Work Programme (NWP)* to help all parties, particularly developing countries, better understand potential impacts and vulnerabilities and develop adaptation strategies. The NWP is structured around nine work areas and engages with, and disseminates information to, a wide spectrum of adaptation stakeholders. Originally launched as a five-year work program, the NWP has been extended and refocused to consider key issues (ecosystems, human settlements, water resources, and health) and to provide support to the CAF. The NWP will be reviewed in 2018 with a view to further enhancing its effectiveness.

Closely related to adaptation is the question of how to address loss and damage resulting from unavoidable climate impacts, including extreme events and slow-onset events. The Cancun Adaptation Framework established a work program to address loss and damage associated with climate change impacts in particularly vulnerable developing countries. COP 19 established the Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts as the main vehicle for carrying this work program forward. COP 20 adopted a work plan and decided on the composition of, and procedures for, the mechanism's executive committee. The Warsaw mechanism is to be reviewed in 2017 at COP 22.

1996	2001	2005	2007	2010	2015
Observing impacts, assessing risks and vulnerabilities – National communications	Moving to planning and pilot implementation – LDC support (NAPAs, LEG, LDCF) – SCCF and Adaptation Fund	Sharing knowledge and lessons learned – Nairobi work programme	Scaling up implementation – Bali action plan	Strengthening institutions – Cancun Adaptation Framework • Adaptation Committee • National adaptation plans • Loss and damage	Agreement expected to provide an additional incentive for adaptation at the national level and help to create absorptive capacity for adaptation finance leading to fullscale implementation

Table 4: A timeline of adaptation-related developments under the UNFCCC process

4.2 National strategies

This section presents a brief outline of the legal and policy frameworks relevant to climate change adaptation in the Mediterranean countries.

4.2.1 Albania

Albania doesn't have currently a separate Strategy on Climate Change but the key policy documents addressing climatic change issues include:

- The National Strategy for Development and Integration 2007-2013
- The Environmental Cross-cutting Strategy 2007-2013,
- The First and Second National Communications to the UNFCCC

In the process of preparation are:

- The Albanian Strategy for Health Adaptation into the Climate Change Context
- The Action Plan for Reducing Vulnerability to Climate Change in Albanian Agricultural Systems

4.2.2 Algeria

The climate change legislative framework in Algeria is based on the law relating to sustainable development and environmental protection, promulgated in 2003 and the National Plan of Actions for the Environment and Sustainable Development which establishes the country's environmental programs over the period 2001-2010.

In 2003, Algeria adopted a National Plan of Action and Adaptation to Climate Change, which was updated in 2013

A 'Plan National Climat de l'Algerie' was produced in 2012; currently under review for a consultative process.

4.2.3 Bosnia and Herzegovina

Bosnia and Herzegovina adopted in 2014 a Climate Change Adaptation and Low Emission Development Strategy. The strategy focuses on the implementation of specific measures aimed to increase resilience

to climate change and define flood risk management and control, as one of the key activities. The Strategy and the Initial and the Second National Communications to the UNFCCC have been endorsed by governments of both entities and the Council of Ministers of Bosnia and Herzegovina, as a ground for implementation of all future projects addressing climate change adaptation.

4.2.4 Croatia

Part of Croatia's 6th National Communication to the UN Framework Convention on Climate Change, (UNFCCC) submitted in 2014, is dedicated to adaptation to climate change. It contains an overview of observed climate change in Croatia, describes climate change scenarios, provides an overview of the impacts and possible adaptation measures to climate change and the proposal of possible researches by areas. The sectors included in the report are hydrology and water resources, forestry, agriculture, biodiversity and natural terrestrial ecosystem, coast and coastal zone, marine ecosystems and fish resources, human health.

Impact of climate change on certain sectors is also described in the last State of the Environment Report of the Republic of Croatia, 2014 (Chapters: Climate change, Air, Forestry, Agriculture, Biodiversity, Water resources management and Water quality, Adriatic Sea, Islands and coastline, Environment and Health) (under adoption).

Croatia started a process of development of National Adaptation Strategy with Adaptation plan in 2014. According to Air Protection Act, this Strategy will cover period until 2040 with a view to the 2070. It is expected that Strategy will be developed and adopted by spring 2017. Action Plan for the five-year period should be developed in parallel with The Strategy.

4.2.5 Cyprus

A draft legal framework on climate change, including adaptation, has been prepared by the Department of Environment. It was discussed at its first reading in public consultation in July 2011 and is undergoing continuous public consultation. Research into the assessment of existing and future impacts on vulnerable economic sectors is also being carried out by several research and academic institutions. Furthermore, certain existing laws in some sectors, incorporating adaptation measures, and are already being applied.

A National Adaptation Steering Committee was established in November 2011, with the participation of all related stakeholders, to facilitate and monitor the progress of the National Adaptation Strategy. The Committee is further divided into thematic sub-committees, dealing with the 9 topics, as described in the EU White Paper on Adaptation.

4.2.6 Egypt

In 2011, Egypt released a National Strategy for Adaptation to Climate Change and, in 2013, a specific Adaptation Strategy for the Ministry of Water Resources and Irrigation was proposed. The proposed Adaptation Strategy prioritises adaptation measures addressing droughts and water scarcity and presents an implementation plan, beginning in 2015, to develop deep groundwater wells, expand agricultural drainage water re-use, construct desalinisation plants, invest in waste water treatment facilities, reduce evaporation losses in Lake Nasser, and increase control over water distribution and efficiency.

In 2010, Egypt published a National Environmental, Economic and Development Study for Climate Change to outline the financial and institutional needs for implementing prospective and ongoing adaptation and mitigation measures. This study recognises that the next phases of climate change planning should include a National Action Plan for Adaptation and National Low Carbon Economy Plan.

Egypt is also a member of the Nile Basin Initiative, a partnership among states along the Nile Rivers established to encourage sustainable socioeconomic development through the equitable division of the Nile Basin's water resources. The Initiative has begun to address climate change within this regional framework and, in 2010 launched the project "Adapting to Climate Change Induced Water Stress in the Nile River Basin" with assistance from UNEP and the Swedish International Development Agency (SIDA).

4.2.7 France

In France, a National Adaptation Strategy was adopted in 2006. Regional impact, vulnerability and adaptation studies were carried out to implement subnational adaptation planning policies (Regional Climate, Air and Energy Schemes process).

A national adaptation plan (NAP) was adopted in 2011, with a five-year implementation period. A review of actions on NAP implementation took place in June 2013. The NAP has prioritised 240 concrete measures covering the 20 thematic areas of the plan: Cross-cutting actions, Health including "Plan Canicule", Water, Biodiversity, Natural hazards, Agriculture, Forests, Fisheries and aquaculture, Energy and industry, Transport infrastructures, Urban planning and the built environment, Tourism, Information, Education and training, Research, Funding and insurance, Coastlines, Mountains, European and international actions, Governance.

4.2.8 Greece

Adaptation policy progress in Greece is still in the agenda-setting stage.

The Ministry of Reconstruction of Production, Environment and Energy, the Athens Academy and the Bank of Greece signed a memorandum of cooperation in the implementation of a "National Strategy for Adapting to Climate Change". The aim of their cooperation is to create a mechanism to monitor implementation of the national strategy and incorporate adaptation policies in all areas. The National Strategy for Adapting to Climate Change is being developed and it will be completed by the end of 2015.

In March 2009, on the initiative of the Bank of Greece, a Committee of scientists was set up in order to produce a study of the environmental, economic and social impacts of climate change in Greece. The Committee finalised the first phase of the project and in June 2011 published a comprehensive study of the impacts of climate change in Greece, addressing in particular the cost of climate change for the Greek economy, the cost of implementing adaptation measures, and the cost of moving to a low-emissions economy in the context of EU climate change mitigation policies. In the current second phase of the project, the Committee is working on a new study to contribute to the formulation of a national adaptation strategy on climate change.

4.2.9 Israel

In 2011, the Ministry of Environmental Protection set up the Israeli Climate Change Information Center, which aims to develop the scientific knowledge base and policy documents that will feed into the national adaptation plan. The Centre has since submitted three reports – the first, in 2012, reviewed existing knowledge on the issue, and identified and prioritised knowledge gaps. The second, also in 2012, provided policy recommendations and an international marketing programme for ICCIC deliverables, while the third, in 2013, reviewed adaptation to climate change in local authorities.

4.2.10 Italy

The process towards an Italian National Adaptation Strategy started in 2013 through the National Project Elementi per l'elaborazione della Strategia Nazionale di Adattamento ai Cambiamenti Climatici, involving more than 100 scientists. Such process has been based on a comprehensive scientific literature review, providing an extensive knowledge on past, present and future climate change and on impacts/vulnerabilities of micro/macro sectors to climate change. The knowledge toolkit produced, through this process, was further enhanced by an ongoing dialogue on climate change adaptation among national, regional and local institutions. The Strategy was finally adopted on June 2015 with a Directorial Decree establishing specific objectives to be reached by 31st December 2016, and will be updated every 5 years.

Sectoral Adaptation Plans are in the development stage.

4.2.11 Lebanon

There is no national strategy or plan regarding adaptation to climate change in Lebanon. As part of the Second National Communication to the UNFCCC in 2011, based on a brief assessment of the country's vulnerability, a set of proposals were put forward for adaptation measures to address climate change in each of the following sectors: agriculture, electricity, water, coastal areas, forests, public health, tourism and settlement and infrastructure.

4.2.12 Libya

To date, Libya does not have any climate change related laws.

4.2.13 Malta

In 2010, the Climate Change Committee for Adaptation was constituted by the Ministry for Resources and Rural Affairs with a view to presenting the National Climate Change Adaptation Strategy - Consultation Document. After taking into consideration the feedback and suggestions received during the Public Consultation process, the Maltese Government launched the National Climate Change Adaptation Strategy in May 2012. The Strategy addresses climate change adaptation in Malta and proposes a number of action points which should be undertaken in various sectors which are likely to be affected by climate change. The Strategy outlines the climate change adaptation policy which should be adopted and indicates which Government entity or Authority is responsible for its implementation as well as the time-frames within which such policy actions should be implemented.

4.2.14 Montenegro

There is no strategic document covering adaptation to climate change in Montenegro, but climate change perspectives have been integrated in its National Strategy on Sustainable Development.

A Technology Needs Assessment for Climate Change Mitigation and Adaptation for Montenegro National Strategy and Action Plan was published in 2012. The assessment describes a set of activities that prioritise technologies for climate change mitigation and adaptation and proposes measures. Finally measures for accelerating the prioritised technological options were developed and form an action plan for implementation of the TNA strategy.

A National Adaptation Strategy and Action Plans are being developed.

4.2.15 Morocco

Morocco has developed a National Plan against Global Warming (PNRC) that was presented at the COP 15 held in Copenhagen in 2009. The Plan provides for reducing greenhouse gas emissions through the development and diversification of clean energy sources and the implementation of adaptation measures that rely mainly on the water strategy and Green Morocco Plan for Agriculture, also launched in 2009.

A wide range of adaptation tools have been incorporated in Morocco' sectoral adaptation strategies, such as in the Water Sector, Agriculture, Forestry, biodiversity and combating desertification, Housing, Fisheries and coastal management, Health and Tourism.

On a broader scope, the adoption of the National Charter for Environment and Sustainable Development allowed Morocco to redouble its efforts to protect the environment and sustainable development. The Charter was formally adopted in 2012 and a Framework Law was enacted in 2014 to help its operationalization which explicitly mentions the fight against climate change and calls for strengthening capacities to promote adaptation to climate change.

4.2.16 Palestine

A "National Adaptation Strategy for Climate Change" has been developed and approved by Palestine. The strategy has identified the agricultural and the water sectors as the most sensitive to present and future climate hazards, leading to a strategic focus of adaptation measures on water and food insecurity.

A National Committee for Climate Change is already active and working towards developing the National Action Plan for Adaptation.

4.2.17 Slovenia

The main cross-sectoral strategic document that included adaptation measures was the Draft Strategy for the Transition of Slovenia to a Low-Carbon Society by 2060, produced in 2011 and published for a second public consultation in March 2012. There are presently no plans for a separate strategy on adaptation as the national Development Strategy of Slovenia is expected to set long term goals for the country also with regard to adaptation, while short term measures will be defined in an Action Plan for Adaptation which will be prepared on the basis of a comprehensive national Climate Change Risk Assessment currently underway.

An Action plan for 2010 and 2011 of the National Adaptation Strategy for Forestry and Agriculture was adopted in 2010. The National Action Plan for climate change adaptation is in the development stage.

4.2.18 Spain

The Spanish National Adaptation Plan, adopted in July 2006, is the reference framework for the development of adaptation policies in Spain. It promotes the coordination between all Public Administrations that deal with the assessment of impacts, vulnerability and adaptation to climate change. It includes all sectors and natural resources acknowledged as potentially affected and is developed through specific Work Programmes. The Spanish Climate Change Office within the Ministry of Agriculture, Food and Environment, coordinates, manages and follows up the implementation of the Action Plan and its Work Programmes. The Plan's general objective is to mainstream climate change adaptation into the planning and management of vulnerable sectors and systems in Spain.

At the Regional level, the vast majority of the Spanish Autonomous Communities have already adopted their adaptation strategies, plans or actions. Most of them have considered adaptation within general

climate change strategies, frameworks or plans in the form of programmes, measures or actions, whereas some others have developed their own Adaptation Strategies or frameworks.

4.2.19 Syria

To date, Syria does not have a climate change adaptation strategy or action plan.

4.2.20 Tunisia

An initial National Adaptation Strategy was developed from 2005 to 2007 in the framework of Tunisian–German bilateral cooperation between the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the Tunisian Ministry for Agriculture and Water Resources.

Again with the support of GIZ, the National Strategy on Climate Change was initiated in 2011 and published in 2012, with the goal of integrating climate change in the country's development strategies. The strategy lists a series of adaptation and mitigation measures to be implemented in various sectors of the economy

It should also be noted that in 2014 the Tunisian Parliament decided to include in the country's new Constitution an article that expressly refers to climate change and the environment, guaranteeing the rights of its citizens to live in a safe environment and participate to the fight against climate change.

4.2.21 Turkey

In 2011, The Ministry of Environment and Urbanization published "Turkey's National Climate Change Adaptation Strategy and Action Plan". The document provides an updated risk analysis for the country and identifies challenges to implementation of adaptation strategies. Vulnerability is categorised into six key areas: water resources management; agriculture sector and food security; ecosystem services, biological diversity and forestry; natural disaster risk management; public health; and crosscutting issues. Broad objectives are listed under each category, and the document offers a comprehensive legal and programmatic analysis of how and where the government may intervene within existing legislation and Ministerial projects.

4.3 International and Regional initiatives and frameworks

4.3.1 Other Regional Seas' Adaptation initiatives

North-East Atlantic

In the context of the Quality Status Report 2010, the OSPAR Commission has produced two documents about the effects of climate change on the marine environment of the North-East Atlantic that will also inform the wider international discussions:

- The "Assessment of climate change mitigation and adaptation" provides an overview of the main challenges for OSPAR to adapt current policies and objectives for the protection of the marine environment. It assesses the needs and options to mitigate climate change relevant for OSPAR's work and to adapt to the consequences of climate change and how this will influence OSPAR's future work. It sets out conclusions and recommendations for OSPAR to respond to the challenges of climate change and ocean acidification.

- The "Assessment of the Impacts of climate change on the North-East Atlantic ecosystem" details the wide range of impacts on marine ecosystems that have been linked to changing climate. These include both the direct physical and chemical impacts on the marine environment and the subsequent impacts occurring in the ecosystems and their biodiversity (publication pending).

OSPAR Commission Contracting Parties continue to establish ways in which to incorporate both climate change and ocean acidification considerations into future work.

Baltic Sea

A "Baltic Sea Region Strategy for Adaptation to Climate Change" together with an Action Plan to promote its implementation were developed in the context of the BaltAdapt project which was funded under EU's Baltic Sea Region Programme 2007–2013 and involved eleven institutions from around the Baltic Sea. The Strategy document was based on Baltadapt scientific reports related to gap-fit analyses on adaptation to climate change research and policy design, impact assessments, vulnerability assessments, stakeholder dialogues as well as on Baltadapt climate info bulletins.

Complementing this main output, the project contributed to the development of an improved knowledge base, called "The Baltic Window", now integrated into the European Adaptation Platform "Climate-ADAPT" as a sub-section under the heading 'Transnational regions'. The sub-section provides information about climate change impacts in the region, sectoral vulnerabilities, examples of adaptation actions and an overview of relevant projects and their outputs.

In parallel, HELCOM (the Baltic Marine Environment Protection Commission) in 2013 published the "Climate change in the Baltic Sea Area" Thematic Assessment, an update of the previous Assessment from 2007, which provides recent information on past and projected future climate change in the Baltic Sea Area and potential impacts of climate change on the Baltic Sea ecosystem.

4.3.2 EU initiatives and policy frameworks

The European Commission adopted in April 2013 the EU Strategy on Adaptation to Climate Change which identifies three priority areas:
1. Promoting action by Member States, through encouraging the adoption of comprehensive adaptation strategies and providing funding to help them build up their adaptation capacities.
2. 'Climate-proofing' action by further promoting adaptation in key vulnerable sectors and ensuring that Europe's infrastructure is made more resilient, and
3. Better informed decision-making by addressing gaps in knowledge about adaptation.

The Commission states that priority will be given to adaptation flagship projects that address key cross-sectoral, trans-regional and/or cross-border issues. In order to support the development and implementation of climate change adaptation strategies and actions in Europe, the European Climate Adaptation Platform Climate-ADAPT has been launched since 2013.

Climate-ADAPT, maintained by the European Environment Agency, represents the main "Climate Adaptation Portal" providing information and data on adaptation and tools specifically designed to facilitate policy makers to understand and implement adaptation. It allows to explore potential adaptation options by selecting a specific climate impact, including sea level rise and flooding, and / or adaptation sector of interest, including coastal areas. Case studies of adaptation measures implemented in specific regions can also be investigated for comparison with similar bio-geographical areas. Climate-ADAPT has a wider European scope also covering information and data related to neighbouring countries that stem from EU projects and initiatives such as the Mediterranean Programme for transnational cooperation, the European Neighbourhood Policy (ENP) for the South Mediterranean and the Euro-Mediterranean Partnership (EUROMED) .

Other relevant EU policies and instruments:

- The Integrated Maritime Policy (and action plan), which permits the sustainable development of maritime-related activities. Its environmental pillar, the Marine Strategy Framework Directive aims to deliver a "good environmental status" of the marine environment by 2020. In addition, the Common Fisheries Policy is being reformed to achieve sustainable fisheries.
- The Water Framework and Floods Directives: In coastal areas, the Water Framework Directive covers transitional and coastal waters up to one nautical mile from the territorial baseline of a member state for a Good Ecological Status and up to 12 nautical miles for a Good Chemical Status. As part of the implementation phase of this directive, almost half of river basin management plans address specific climate change adaptation measures. The Floods Directive devotes attention to the impact of coastal floods.
- The Natura 2000, Habitats and Birds Directives: The Natura 2000 network protects a large percentage of coastal and marine regions. The European Commission produced "Guidelines on Climate Change and Natura 2000" which were intended for site managers and policy-makers. The guidelines focus on practical advice and the key principles involved in developing adaptive management for climate change. They also underline the benefits from Natura 2000 sites in mitigating the impacts of climate change, reducing vulnerability and increasing resilience, and explaining how the adaptation of management for species and habitats protected by Natura 2000 (such as green infrastructure and other ecosystem based approaches) can be used to tackle the effects of climate change.
- The EU Maritime Spatial Planning Directive: One of the most recent EU achievements is the Maritime Spatial Planning Directive. Launched on 12 March 2013, it was adopted in July 2014. This new initiative aims to establish a framework for maritime spatial planning in EU member states that will promote the sustainable growth of maritime activities and the sustainable use of coastal and marine resources. Climate change is mentioned in the preamble and in the objectives of the directive, stating member states will seek to improve the resilience to climate change impacts through their maritime spatial plans.

4.3.3 The Union for the Mediterranean (UfM)

Climate change is one of the main axes of regional cooperation that the Head of States of the Euro-Mediterranean countries referred to in their Joint Declaration at the Paris Summit (13 July 2008) establishing the UfM, as well as in their Final Statement (Marseille, 3-4 November 2008).

The UfM Ministerial Conference on Environment and Climate Change took place on 13 May 2014, in Athens. The declaration of the Meeting included climate change for the first time as a priority area of cooperation for the UfM and underlined the urgency to address climate change due to its close connection with other major regional concerns, such as energy, water scarcity, desertification, food security, overpopulation and resilience to extreme weather events.

The Declaration established two regional bodies:

- the UfM Climate Change Expert Group, bringing together technical experts by governments, agencies, civil society, relevant international institutions including international donors, private sector representatives and other experts from the Mediterranean region
- the UfM Working Group for Environment and Climate Change which is meant to ensure a regular follow up and monitoring of agreed actions, and their adjustment if need be. It is expected to include high level experts and officials of the UfM countries, institutions and stakeholders.

4.3.4 Arab Framework Action Plan on Climate Change, 2010-2020

The Arab Framework Action Plan on Climate Change, 2010-2020 was elaborated in the League of Arab States (LAS) framework and was agreed by the Council of Arab Ministers Responsible for the

Environment on 2012. The Framework aims at enhancing the Arab Countries' capacity to take appropriate measures for addressing climate change issues while achieving sustainable development targets and MDGs in the Arab Region. It includes mitigation and adaptation objectives. UNEP ROWA and UN ESCWA provided technical assistance for its elaboration.

Its adaptation focus is on:

- Vulnerability assessments of the economic and social development in the Arab region to climate change;
- Adaptation strategies in a range of sectors, including climate & meteorology; water, land and biodiversity; agriculture and forestry; industry; construction; population and human settlements; public health; seas and coastal areas;
- Preparation and implementation of strategies for disaster risk reduction.

Linkages have been secured with other horizontal and sectorial LAS strategies such as the Arab Strategy for Disaster Risk Reduction 2020 and the Arab Water Security Strategy 2010-2030.

4.3.5 South East Europe 2020 Strategy

The South East Europe 2020 Strategy (adopted at the Ministerial Conference of the South East Europe Investment Committee in Sarajevo, November 2013) aims at improving living conditions in the region and bringing competitiveness and development back in focus. It was developed in the framework of the Regional Cooperation Council and aspires to provide a major vehicle for growth in SEE. The direct participants in the SEE 2020 Strategy are: Albania, Bosnia and Herzegovina, Croatia, Kosovo, Montenegro, Serbia and The Former Yugoslav Republic of Macedonia. The SEE 2020 Strategy closely follows the vision of the EU 'Europe 2020 Strategy' demonstrating the clear orientation of SEE countries towards EU integration and, ultimately, accession.

Climate change aspects are dealt in a cross-cutting approach in the Strategy, with Environment and Energy being its two key relevant Dimensions. The Environment Dimension tackles adaptation issues, including by linking water, agriculture, forestry, tourism and risk management elements. The Energy Dimension tackles mitigation, including energy efficiency and renewable energy elements.

Foreseen activities include soft interventions and investment. Awareness raising, education, sharing of experiences and demonstration activities are among the cross-cutting activities. The engagement of a range of authorities (Ministries of Environment; Water; Energy; Interior, Health, Agriculture & Forestry), local authorities, civil society, professional cooperatives, private sector, academia and media, is anticipated.

4.3.6 Global Adaptation Network

The overall objective of the Global Adaptation Network (GAN) is to help build climate resilience of vulnerable communities, ecosystems and economies through the mobilization of knowledge for adaptation which are critical to informing adaptation decision-making, planning and practice.

The development of the GAN involved a broad UNEP-facilitated consultative process that ran from late 2008 to mid-2010, including an international consultation meeting and four regional consultations. The key needs identified at the global level through this process include the mobilization of existing information and knowledge, provision of targeted and packaged support and advisory services, building capacity for the uptake of knowledge, and linking the supply of expertise and knowledge with the demands. These needs have also been frequently expressed through the UNFCCC processes.

Regional adaptation networks are the building blocks of the Global Adaptation Network. Currently there are three regional networks linked to the GAN that are operational: the Regional Gateway for

Technology Transfer and Climate Change Action (REGATTA) in Latin America and the Caribbean, the Asia Pacific Adaptation Network (APAN), and the West Asia Regional Network on Climate Change (WARN-CC). The Africa Adaptation Knowledge Network is in the process of being established. The Global Adaptation Network forms a light umbrella structure, linking the regional networks and helping them to exchange knowledge, experiences and lessons learnt.

The GAN, together with the Regional Networks, aims to build bridges between already existing adaptation networks and knowledge management initiatives, and to complement the services offered through its focus on the provision of integrated knowledge sources and targeted support and advisory services. It also provides a platform for facilitating access to knowledge services provided by other networks and initiatives.

4.3.7 Mayors Adapt

Mayors Adapt is an initiative of the European Commission in the context of the EU Adaptation Strategy, is implemented within the Covenant of Mayors, the flagship European initiative for cities to reduce their greenhouse gas emissions and is supported by the European Environment Agency (EEA).

Mayors Adapt provides a framework for local authorities to take action on adapting to climate change. Its key objectives are to:

- Inform: Dedicated events provide information and raise awareness on adaptation for decision-makers, multipliers and other actor groups.
- Mobilise: Mayors Adapt encourages cities to capture the opportunities of taking action on adaptation
- Support: A dedicated helpdesk and quick access to existing expertise empowers cities in setting up and implementing local adaptation plans
- Facilitate: Comprehensive city profiles offer an opportunity to learn from best-practices, and encourage an active network among cities who benefit from each other's experiences.
- Enable: The initiative offers a unique platform for signatory cities to showcase their activities and engagement. It raises their profile as leaders in action on climate change adaptation.

Participating cities commit to either develop a comprehensive adaptation strategy for the local authority or to integrate adaptation to climate change into their relevant existing plans. In order to support urban adaptation decision-makers and interested stakeholders, an Urban Adaptation Support Tool has been developed with a step-by-step guidance through the adaptation planning and implementation cycles, providing practical guidance and knowledge support to signatory cities as well as to any other interested cities, towns or stakeholders.

The initiative is not restricted to cities in EU countries. On 7 May 2015, 24 mayors and representatives of local authorities from six countries in the south Mediterranean region (Morocco, Algeria, Tunisia, Lebanon, Palestine and Israel) signed up to the Covenant of Mayors initiative, committing to help reduce greenhouse gas emissions. The signing ceremony organised by the European Commission and the EU project Cleaner Energy Saving Mediterranean Cities (CES-MED) was held in Skhirat, Morocco.

5 PRIORITY DIMENSIONS OF ADAPTATION POLICIES

It is beyond the scope of this overview to provide specific adaptation measures relevant to the coastal and marine areas of the Mediterranean. However, we consider useful to briefly present 5 dimensions or approaches that any adaptation strategy should consider as a priority, namely the implementation of low-regret measures, the synergies between adaptation and both disaster risk management and mitigation, the integration of adaptation perspectives into ICZM, the use of Ecosystems-based adaptation approaches.

5.1 Identifying and implementing low-regret measures

Uncertainty around long-term changes in the climate is and will remain inherent to adaptation decision making, especially at the national and local scale. In the presence of such uncertainties, adaptation to climate change may be advanced by anticipating a wide range of potential climate change-related risks by favouring and promoting

- Reversible and flexible options enabling amendments to be made if needed in the future
- "Low-regret" (or ‘‘no-regret") options that yield benefits even in absence of climate change and where the costs of the adaptation are relatively low vis-à-vis the benefits of acting
- "Win-win" options that have the desired result in terms of minimising climate risks or exploiting potential opportunities, while at the same time providing other social, environmental or economic benefits, including those relating to mitigation.

One of the principal benefits of such an approach is that it enables authorities and other stakeholders to start implementing short-term adaptation actions and in doing so begin the adaptation process, rather than adopt a ‘wait and see approach’.

Once low-regret measures have been identified, it is important to also identify the obstacles to their implementation so far, such as financial, technology, information, institutional and legal constraints. These obstacles can then be addressed in adaptation planning as a first step in a long-term adaptation strategy.

IPCC’s SREX report includes a large table with a selection of disaster risk reduction and adaptation to climate change options by selected sectors (Table 6-1 in that report). The following table, from Table 6-5 from the same report, presents a very shorter version, with ‘no or low regrets’ strategies that reduce the effects of disasters and enhance resilience to projected changes.

'No or low regrets' practices with demonstrated evidence of having integrated observed trends in disaster risks to reduce the effects of disasters	**Practices that enhance resilience to projected changes in disaster risk**
• Effective early warning systems and emergency preparedness • Integrated water resource management • Rehabilitation of degraded coastal and terrestrial ecosystems • Robust building codes and standards reflecting knowledge of current disaster risks • Ecosystem-based/nature-based investments, including ecosystem conservation measures • Micro-insurance, including weather-indexed insurance • Vulnerability-reducing measures such as pro-poor economic and human development, through for example improved social services and protection, employment, wealth creation	• Crop improvement for drought tolerance and adaptive agricultural practices, including responses to enhanced weather and climate prediction services • Integrated coastal zone management integrating projections of sea level risk and weather/climate extremes • National water policy frameworks and water supply infrastructures, incorporating future climate extremes and demand projections • Strengthened and enforced building codes, standards for changed climate extremes • Advances in human development and poverty reduction, through, for example, social protection, employment, and wealth creation measures, taking future exposure to weather and climate extremes into account

Table 5: Range of 'no or low regrets' practices and those integrating projected changes in disaster risk. Source: IPCC SREX Report

5.2 Integrating climate adaptation and Disaster Risk Management

5.2.1 Climate Adaptation and Disaster Risk Reduction

Despite many overlaps, Disaster Risk Reduction (DRR) and adaptation have traditionally evolved separately, with distinct differences. For example, DRR focuses on current and near-term risks, as well as remediation after disasters, while adaptation typically takes a longer view. Recently, the two approaches are increasingly being linked.

In this context, seminal has been the IPCC's Special Report from 2012 "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" (widely known as SREX), which notes that disaster risk arises from the combination of both climate change and variability, and faulty development practices and suggests that adaptation and disaster risk reduction should work in harmony. Both DRR and adaptation are concerned with reducing vulnerability and exposure, monitoring hazards, and raising societal capacities to reduce and manage risks. Importantly, both adaptation and DRR have to be understood in the context of wider social and economic development. Development can exacerbate disaster risks, both in the long run – by increasing greenhouse gas emissions that drive climate change – and in the near term, by creating or worsening hazards. At the same time, development is a key factor in reducing vulnerability.

As discussed in (SEI 2014), an effective way of bringing adaptation into disaster risk reduction is to take vulnerability reduction as the starting point, rather than risk reduction. Vulnerability reduction is about changing the underlying conditions that make people susceptible to harm, and thus requires a more fundamental examination of the development pathways that both create and reduce risk. Social welfare, quality of life, infrastructure and livelihoods need to be part of disaster risk reduction to facilitate adaptation to climate change. Thus, rather than thinking about how to address risk, the focus should be on addressing the greatest drivers of risk.

5.2.2 The International DRR Framework

On the 3rd United Nations World Conference on Disaster Risk Reduction (WCDRR) in Sendai, Japan (14-18 March 2015), more than 5,000 government officials, ministers and leaders from over 160 countries agreed a new global framework to guide decision makers towards a more disaster-resilient future, known as the Sendai Framework.

The agreed text places a strong emphasis on tackling the underlying drivers of risk, including: poverty, climate change, ecosystem decline, bad urban planning, land use and risk governance. It includes seven global targets (most of which are not quantifiable) and sets out four priority areas for further action, presented below:

Targets

- Substantially reduce global disaster mortality
- Substantially reduce the number of affected people globally
- Reduce direct disaster economic loss in relation to global GDP
- Substantially reduce disaster damage to critical infrastructure and disruption of basic services
- Substantially increase the number of countries with national and local disaster risk reduction strategies
- Substantially enhance international cooperation to developing countries
- Substantially increase the availability of and access to early warning systems and disaster risk information

Priority areas for further action

1. Understanding risk
2. Risk governance
3. Investment in resilience
4. 'Build back better' in recovery and reconstruction phases post-disaster

As a key contribution to the Conference, the World Meteorological Organization (WMO) announced plans to support Governments and other stakeholders in developing effective multi-hazard early warning systems that provide a coordinated platform for managing multiple risks. Together with its partners, WMO is proposing an International Network for Multi-Hazard Early Warning Systems. The IN-MHEWS would advise on the best-available scientific, technological, and social knowledge and techniques for delivering early warnings and building climate resilience.

It would also provide support in strengthening inter-agency coordination, adopting the most up-to-date communications techniques, identifying the most appropriate and cost-effective technologies and systems, and engaging the public and local decision-makers in building climate resilience.

5.3 Integrating climate resilience into the ICZM process

In the context of the ClimVar & ICZM project, PAP/RAC prepared the "Guidelines for Adapting to Climate Variability and Change along the Mediterranean Coast" report (UNEP/MAP/PAP, 2015). The main aim of this document is to provide planners and policy-makers in the Mediterranean with information on how climate change impacts can be integrated into the Integrated Coastal Zone Management (ICZM) process. More specifically, it offers guidance on how to integrate climate considerations to the 5 stages envisaged for the preparation of national ICZM strategies, plans or programmes.

5.3.1 Establishment stage

The main task is to ensure institutional co-ordination with bodies responsible for climate adaptation and mitigation strategies and plans. All countries have an obligation to submit a report to the UNFCC that not only details greenhouse gas emissions but also provides vulnerability assessments and actions to

adapt to climate change. Any actions on climate change under the ICZM should be coordinated with the national communication office of that country. In addition, local authorities in many coastal zones are already planning to introduce measures to respond to some of the expected impacts of climate change. It is essential that these authorities and their plans and procedures be brought into the ICZM process at this initial stage.

These climate issues should be noted in the strategy, and plans for the ICZM should ensure that the conditions are met. The plans should also identify the key stakeholders.

The scoping report, which is the output of this stage, should cover co-ordination mechanisms, boundary definition, governance context, initial drivers and pressures, key problems and issues, risk identification, stakeholder analysis, a vision proposal, a decision on strategic environmental assessment (SEA) and the work plan.

5.3.2 Analysis and Futures stage

The first stage in this section of the ICZM process is "building the evidence" and aims to establish an operational foundation for the preparation of the strategy or plan and its implementation. From a climate viewpoint the key tasks are:

- to identify the main elements of climate variability and change in the short- (10-20 years), mid- (30-40 years), and long-term (60+ years); and
- to assess the impacts of this variability on key sectors and the risks associated with them.

The second stage is "building the future" and involves identifying policies and priorities for action based on the above information and taking into account the effects on all three pillars of sustainable development: economic, environmental and social. The range of policies and options need to be identified in the strategy, along with possible pilot actions and sources of funding. The selection of the actual policies and options will be made when drawing up the national and local plans as well as the elaboration of the pilot actions and sources of funding will be made.

5.3.3 Setting the Vision stage

This stage includes 3 components: Building consensus, setting the direction and measuring success

The point of departure for the building consensus stage is the scoping report, which was prepared at the establishment stage. This report is discussed with stakeholders and amended in light of their reactions. Stakeholder consultations are also used to determine priorities. A broad range of stakeholders including governments, private business, scientists and civil society organizations should be engaged at the start of the process to ensure ownership of adaptation interventions, but also afterwards through the appropriate long-term organizational and institutional arrangements to ensure more effective implementation and sustainability.

The aim of the "Setting the direction" subsection, is the vision statement, a general statement that defines broad priorities. The objectives that arise from the vision statement can be complex, consisting of High Level Objectives (or Goals) and clusters of Sub-Objectives. In addition, some objectives will be predetermined in existing international, national and sub-national policies. On the climate front a clear statement is needed of the importance given to adaptation to climate change as a high level objective. This may be followed by a list of the areas in which action is required and the cross sectoral priorities (e.g., adaptation to climate versus short term development imperatives).

The "Measuring success" subsection is about tracking whether the plan's interventions are achieving their intended objectives, using indicators that have to be linked to the output or outcome being measured.

These guidelines propose three types of indicators:
1. Sustainability Indicators that show how the strategy or plan is being realised;
2. Impact Indicators that measure how well the strategy or plan outputs are being achieved; and
3. Performance Indicators that measure how well the projected activities are being implemented.

5.3.4 Designing the Future stage

The first subsection in this stage is formulating ICZM strategies, plans and programmes with specific climate-related elements, including measures related to sea-level rise, changes in land-use regulations, and measures designed for agriculture, tourism, health, water and ecosystems, primarily in conjunction with national policies in these areas.

The second subsection is about establishing a management structure, ie setting up inter-sectoral management, long-term facilitation and consultation structures, and the post-plan period.

The third subsection is about estimating changes in the monitoring indicators mentioned above, as the strategy or plan is implemented, eg at five-year intervals. The estimation of indicators is made as part of the implementation of the strategy or plan.

5.3.5 Realising the Vision stage

ICZM has a wide range of instruments to implement the strategy. A central pillar is land-use regulation and the limitation on the use of certain areas on environmental grounds. Also important is the adoption of standards for the construction, energy and other sectors that provide goods and services. In addition, it is increasingly important to use fiscal instruments to promote certain actions that are considered desirable. The range of instruments to be used in the ICZM should be identified in the strategy, along with some priorities indicating which instruments are preferred from a national viewpoint. The actual selection, however, will be made at the planning stage, national or local as appropriate.

The ICZM should not give priority to “hard” infrastructure solutions such as sea walls, dikes and desalinisation facilities, but it should look in the first instance for less expensive “soft” options. However, some investments will be needed and some investments that are part of the development plan will have to be modified in light of climate change. The ICZM should provide guidance to the private sector on how to address additional climate risks.

Finding and securing finance is part of this stage in the development of ICZM strategies and plans.

Finally, it is critical that planners continuously track information on climate impacts as new data is continuously appearing. This data may affect proposed adaptation actions, which should be revisited periodically to incorporate any new knowledge. For all aspects of ICZM it is also important to monitor the success of any actions taken in achieving their goals, and what the impact has been of introducing relevant measures.

5.4 Ecosystems based Adaptation (EbA)

Fundamentally, Ecosystems based Adaptation (EbA) is about the use of natural capital by people in order to adapt to climate change impacts, which can also have multiple co-benefits for mitigation, protection of livelihoods and poverty alleviation. Such approaches address the crucial links between climate change, biodiversity and sustainable resource management and, by preserving and enhancing ecosystems, enable society to better mitigate and adapt to climate change.

Healthy, fully functioning ecosystems are more resilient to stressors and therefore better able to support adaptation to climate change impacts. Healthy ecosystems also imply a greater element of flexibility in adaptation response options. However, ecosystems continue to be degraded not only due to climate change, but also due to pollution and unsustainable over-exploitation. Restoration of degraded ecosystems as part of an EbA, beyond its adaptation objectives, also provides a mechanism for carbon sequestration -and hence climate change mitigation- as well as sources of employment and enhancement of resources to support livelihoods.

EbA has already proven its worth in many situations and evidence is emerging of its success in helping people adapt to climate variability and change. Harnessing the adaptive forces of nature is economically viable and effective to combat the impacts of climate change. Its potential for synergies with other adaptation options, climate mitigation strategies and development goals warrants EbA having a prominent place in both the national and international funding mechanisms now taking shape to fuel global adaptation efforts and in the adaptation decision-makers toolbox. With the impacts of climate change increasingly being felt across the world, it is important to scale up the approach to increase society resilience to climate change as well as to achieve more sustainable economic development.

UNEP's Ecosystems based Adaptation programme aims to help vulnerable communities in developing countries adapt to climate change through good ecosystem management practices, and their integration into global, regional, national and local climate change strategies and action plans. It is delivering specific products and services responding to country needs to support EBA mainstreaming through

- Assessments and knowledge support. Countries are supported in conducting impact and vulnerability assessments by undertaking analysis of ecosystem services for adaptation and their economic value, and therefore helping convert these results into a knowledge base with which decision makers can design and implement priority EBA policies and projects.
- Capacity building and demonstration. This component is helping create the enabling conditions for implementing EBA options, including technology development and diffusion, piloting and demonstration and capacity building.
- Integration of EBA options into national adaptation plans. The establishment of a coordinated and integrated approach with institutional structures that are capable of mobilizing different stakeholders is supported through modifying the frameworks and processes that are used to develop or revise policies, programs and projects. The activities will include economic analysis of different EBA options, support for policy setting and legislation, as well as feasibility studies for large-scale investment in EBA projects.

5.5 Promoting synergies between adaptation and mitigation

In the past, mitigation and adaptation had evolved along different pathways, mainly based on the suggestion that mitigation is a global issue whilst adaptation is a local one. Recently, it is being increasingly realized that the integration of adaptation and mitigation responses and the creation of synergies between them can increase the cost-effectiveness of actions, make them more attractive to stakeholders, including potential donors, and generate mutual benefits, as well as introduce co-benefits with development policies.

Synergies of mitigation and adaptation can be identified in many concrete policy options, most of them strengthening the role of natural resources in environmental management. Typical examples of measures that enhance adaptation and mitigation goals simultaneously, include:

- Carbon storage from coastal wetland restoration or reforestation with native and diverse tree species or soil conservation, which at the same time provide storm buffer, species habitat protection, flood control, improved nutrient and water retention, increased soil biodiversity.
- Reduced energy consumption due to buildings' thermal insulation, which at the same time provides human comfort and health benefits due to increased protection from heat.

However, it is crucial to avoid negative trade-offs between adaptation and mitigation, or between economic goals and environmental goals.

In some cases, for example, adaptation measures may increase greenhouse gas emissions. Such examples include the increase in the consumption for fossil fuels for air conditioning in response to higher temperatures or desalination and increased water pumping. Similarly, some mitigation measures may impede adaptation, such as the construction of dams for hydropower which contribute to the reduction of sediment input into the sea and therefore aggravate coastal erosion, or the production of biofules which may increase competition for limited land and water resources.

6 MOBILISING AND ACCESSING FUNDS FOR ADAPTATION

Climate change is largely the result of the conventional, carbon-intensive infrastructure, investments and markets. Our challenge is to redirect investments from that traditional model toward green infrastructure, green technology and green finance. This economic transition towards climate compatibility requires a re-deployment of global investment the likes of which the world has never seen. Focusing only on the adaptation pillar of the response to the climate change challenge, UNEP's first Adaptation Report (UNEP 2014), estimates that the global investment required for adaptation to climate change will likely oscillate between 150 and 500 billion USD per year until 2050. On the mitigation side, the IPCC AR5 mentions estimates that in order to keep the global temperature increase below 2°C, additional investment required in the energy supply sector alone is estimated to be between $190 and $900 billion per year through to 2050.

6.1 The international climate financing framework under the UNFCCC

Under the United Nations Framework Convention on Climate Change (UNFCCC), developed countries have made a commitment to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting the cost of adaptation to those adverse effects (Article 4.4). It should be noted however that historically, the majority of climate-related funding has been delivered by developed countries not through the financial mechanisms of the Convention but through other bilateral, regional or multilateral channels.

At the 15th UNFCCC Conference of the Parties (COP 15) in Copenhagen in 2009, developed country Parties committed "*to a goal of mobilizing jointly $100 billion dollars a year by 2020 to address the needs of developing countries*". The Parties agreed this funding would come from a "*wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance*". One year later, at COP 16 in Cancun, all Parties endorsed the $100 billion goal, and the next year, at COP 17 in Durban, they established a work program to analyze options for scaling up the mobilization of climate finance. In 2012, COP 18 in Doha called on developed country Parties to identify pathways for mobilizing the scaling up of climate finance.

As part of its response to the climate change challenge, the international community established a number of multilateral funds to serve as vehicles for the provision of financial resources to assist developing countries in the implementation of their commitments under the UNFCCC. These include the two Operating Entities of the financial mechanism of the Convention – the Global Environment Facility (GEF) and more recently the Green Climate Fund (GCF) – as well as three special purpose funds, namely the Kyoto Protocol Adaptation Fund (AF), the Special Climate Change Fund (SCCF) and the Least Developed Countries Fund (LDCF) which is not relevant for the Mediterranean region.

6.1.1 Special Climate Change Fund (SCCF)

The SCCF, established under the Marrakech Accords in 2001 and managed by the Global Environmental Facility (GEF), finances adaptation, technology transfer, mitigation, and economic diversification in developing countries. There are two active funding windows under the SCCF: an adaptation window (SCCF-A) and a Technology Transfer window (SCCF-B). The fund supports short- and long-term adaptation activities in water resources management, land management, agriculture, health, infrastructure development, fragile ecosystems, and integrated coastal management. Of the $348 million pledged to the SCCF, $241 million has been allocated to 57 adaptation projects.

6.1.2 Adaptation Fund

The Adaptation Fund was established under the Kyoto Protocol and has been financed primarily through a 2% levy on proceeds from the Clean Development Mechanism (CDM), supplemented by voluntary contributions. It supports concrete adaptation projects and programs in developing countries that are particularly vulnerable to the adverse effects of climate change. The fund is operated by the Adaptation Fund Board, which has dedicated $265 million to increase climate resilience in 45 countries. However, with demand and prices for CDM credits currently at very low levels, Annex I parties and international organizations have been encouraged to scale up funding with a view to reaching the AFB's new fundraising goals of $80 million per year in 2014 and 2015.

6.1.3 Green Climate Fund (GCF)

The Green Climate Fund, established under the COP 16 Cancun Agreements in 2010, is expected to become the main instrument to finance adaptation measures in much of the developing world. With the initial resource mobilization process of the Fund being completed at the end of 2014 with pledges of 10.2 million dollars, the GCF is scheduled to start programing resources in the second half of 2015. The GCF Board has decided that 50% of its portfolio should be allocated to adaptation and, in turn, that 50% should go to particularly vulnerable developing countries including Least Developed Countries (LDCs), Small Island Developing States (SIDS) and Africa

The GCF requires that funding should be allocated to 'paradigm-shifting' projects and programs. Countries that can show that they have given full and reasoned consideration to the adaptation measures and associated costs of meeting the impacts of climate change in their country will likely be better placed to put together proposals with a high probability of approval. Additionally, there is a growing appreciation of the need for beneficiary countries to have explored opportunities for funding adaptation costs from within their own resources, whether in terms of existing public expenditure or possible reforms or re-allocations.

The GCF will be accessible through national, regional and international implementing entities and intermediaries building on the experience of the direct access modality piloted by the Adaptation Fund. Institutions interested to work with the GCF have to go through an accreditation process, which will screen their capacities to comply with the Fund's fiduciary standards and environmental and social safeguards.

6.2 Other international funding opportunities relevant to the Mediterranean region

In terms of size and scope another important set of funds located outside the UNFCCC are the Climate Investment Funds (CIFs) and the Pilot Programme for Climate Resilience (PPCR) that is hosted under them. They are administered by the World Bank and use the Multilateral Development Banks (MDBs)[3] for programme and project implementation. The CIFs will conclude their operations once a new financial architecture becomes effective under the UNFCCC.

Other traditional multilateral supporters of the regional development agenda that are expected to increase their portfolio on climate change include:

- the Arab Fund for Economic and Social Development,
- the African Development Bank,
- the European Investment Bank,
- the European Bank for Reconstruction and Development,
- the European Neighborhood and Policy Instrument,
- the Horizon 2020 Programme,

[3] African Development Bank (AfDB), Asian Development Bank (ADB) European Bank for Reconstruction and Development (ERBD), European Investment Bank (EIB), Inter-American Development Bank (IADB), World Bank (WB) and International Finance Cooperation (IFC).

- the Western Balkan Investment Framework and
- the Islamic Development Bank.

In addition to these major multilateral funds, many developed countries also finance adaptation in self-selected developing countries through their respective bilateral development assistance agencies. Key bilateral donors in the agenda include France, Finland, Germany, Italy, Netherlands, Spain, Sweden as well as Norway and Switzerland, and some overseas countries including Japan and the US.

Another emerging funding mechanism that is increasingly popular, is the issuance of Green Bonds. They are fixed income, liquid financial instruments that can be issued by governments, multi-national banks or corporations and the funds they raise are dedicated exclusively to climate-mitigation and adaption projects, and other environmentally beneficial activities. This provides investors an attractive investment proposition as well as an opportunity to support environmentally sound projects. The total volume of Green Bonds was $11 billion in 2013 and $36.6 billion in 2014. The largest issuers of labelled green bonds to date are the European Investment Bank ($11.6bn) and the World Bank ($8bn), with German development bank KfW ($4bn) in third place. Issuance of corporate green bonds is increasing with the largest ones issued so far being those by GDF Suez (€2.5bn) and EDF (€1.4bn). Municipalities and commercial banks are also showing increasing interest in the sector. According to the Climate Bonds Initiative, the majority of green bond proceeds are allocated to renewable energy (38.3%) and low carbon buildings and industry (27.5%), followed by transport (10.2%). The share of green bonds explicitly targeted to adaptation was 4.3% while related sectors also received small but significant shares of green bond proceeds: Water management 9.7% and agriculture & forestry 3.9%.

6.3 Adaptation financing priorities at the national level

While international climate finance is critical, it is expected that eventually a large majority of such funds will be generated, managed and mainstreamed by the implementing country.

Achieving climate change objectives at the national level will involve both economic and regulatory public interventions as well as changes in the government's provision of goods and services. All these interventions will undoubtedly require additional public finance to be managed across most public institutions. But what is required is not just an increase in expenditures dedicated to climate-related activities, but also a qualitative shift across government in the overall composition of expenditures, so that 'harmful' expenditures are reduced and potential synergies with traditional developmental spending are maximised.

As already mentioned in the presentation of the GCF, in the discussion around 'climate finance' there is growing interest in building countries' readiness to plan for, access, deliver and monitor 'climate finance'. International agencies such as GCF are pushing for country-led approaches and for requests to be seen as strategic allocations to key areas in the national climate response. In this context, the Climate Public Expenditure and Institutional Review (CPEIR) methodology, first pioneered in Nepal with UNDP and UNEP support in 2011, seeks to move away from a parochial focus on the use of "climate dedicated" funds and rather aim to help countries review how their own stated national climate change policy aims are being reflected in public expenditures more broadly, and how institutions might be adjusted to ensure that financing a response to climate change is delivered in a coherent way across government.

In that regard, a CPEIR involves:

- An assessment of current policy priorities and strategies as these relate to climate change;
- A review of institutional arrangements for integrating climate change policy priorities into budgeting and expenditure management processes;
- An analysis of public expenditure and its relevance to climate change.

Public finance is obviously crucial in order to build a country's resilience against climate change, but can only provide a portion of the huge capital required. Nationally and internationally, the bulk of the financing required will have to be mobilized from private sector sources.

Green investments can generate positive and long-term financial returns, often without even accounting for externalities. But the currently prevailing economic framework and structure still incentivizes conventional short-term and carbon-based investments and disadvantage long-term, sustainable economic choices. Financial market reform is essential in order to improve effectiveness in attracting private capital and channeling it to green investments. In order to avoid distortions that can lead to a misallocation of capital and a danger of systemic risks to the economy and the natural environment, long-term environmental risks need to be effectively accounted for and green opportunities to be adequately valued, including the emergence of new business opportunities and new markets.

Finally, emerging and innovating mechanisms need to be considered. An interesting example is the Microfinance for Ecosystem-based-Adaptation to Climate Change (MEbA) project which was initiated in April 2012 in Colombia and Peru with the support of the UNEP Regional Office for Latin America and the Caribbean. The main pillars of the projects are (1) the assistance in the development and implementation of new financial products and services tailored to rural populations that are vulnerable to the effects of climate change (2) the provision of customized capacity building to Microfinance Institutions and, (3) awareness raising and carrying out training activities which address identified knowledge gaps to increase climate change resilience with a focus on Ecosystem-based Adaptation via partnerships with key local technical actors.

6.4 The role of the banking and insurance sectors

Climate change poses a major risk to the global economy: it affects the wealth of societies, the availability of resources, the price of energy and the value of companies, and consequently the banking sector together with all financial institutions. With predictions of more frequent and severe extreme weather events, the insurance industry is on the "front line" of climate change risks and generally at the heart of a sustainable financial system in its role as risk manager, risk carrier and investor.

Both sectors face a number of problems related to the accurate pricing of risks, shortage of capital after large loss events and an increasing burden of losses that can affect markets and insurability. By way of example, the banking sector is potentially affected by physical impacts on assets and investments. The insurance industry is affected by drought and storm damage to property and agriculture, and faces a new challenge of adapting internal processes, corporate policies and products and services to meet the challenges its clients face. The relevance and implication of both sectors was emphasised at the UN Climate Summit in New York in September 2014 where the message was that actors from the financial sector, including banks and insurers, must play an important role in building resilience through integrating risk management into business practices.

In 2012 at the UN Conference on Sustainable Development, a new initiative –the Principles for Sustainable Insurance (PSI)– was launched by UNEP to "*serve as a global framework for the insurance industry to address environmental, social and governance risks and opportunities*". "Sustainable insurance" is a strategic approach where all activities in the insurance value chain, including interactions with stakeholders, are done in a responsible and forward looking way by identifying, assessing, managing and monitoring risks and opportunities associated with environmental, social and governance issues. It aims to reduce risk, develop innovative solutions, improve business performance, and contribute to environmental, social and economic sustainability. More than 70 insurers have joined this initiative to date, which has a focus on climate risks as part of its attention to addressing social, environmental and governance issues, and working towards disaster risk reduction.

The main 2014-2015 programme launched by the PSI is the Global Resilience Project, which aims to shift the focus away from post-disaster reactivity to "upfront measures that reduce disaster risk". Part of

the focus is on flooding which is established as a natural phenomenon exacerbated by climate change. The project consists of three phases, the first of which – a report on how to build disaster-resilient communities – was launched in June 2014. The second phase comprises the building of global and country natural disaster risk maps to identify particular areas of exposure and vulnerability. The third phase will develop supportive country-level stakeholder engagement strategies and plans for predisaster resilience.

Under the ClimVar & ICZM project, PAP/RAC prepared the report "Study of banking and insurance sector practices to address climate change variability in the context of Integrated Coastal Zone Management (ICZM) in the Mediterranean Region". The report identified four key areas that should be considered to enhance further climate action in the banking and insurance sectors:

6.4.1 Enhance knowledge and raise awareness on climate risks

A better understanding of how climate risks affect the environment and human life and an increased awareness among both decision-makers and the general public are critical in order to build a resilient economy.

Public authorities need to develop tools such as risk zoning (e.g. flood or erosion zoning), make meteorological and climate data available to the general public through open source data initiatives and promote the development and use of standardized international metrics related to climate risk and exposure.

Banking and Insurance companies should:

- Integrate climate risk disclosure in their financial oversight processes
- Develop and use climate impact assessments as tools to strengthen lending policies integrating climate risks
- Strengthen the capabilities of their staff and human resources to better understand the impacts of current and future climate risks on their activities/products/services

6.4.2 Reinforce climate risk prevention services

In order to improve better prevention practices relevant to climate risks, bank and insurance companies should dedicate operational human resources to develop appropriate products and offer related services to their clients as well as to the general public by:

- Improving customers' awareness by communicating the risks associated with climate change through pricing and underwriting;
- Considering climate-related asset value erosion in the evaluation of real estate and bond investments;
- Educating clients about the benefits and processes being used to incorporate extra-financial issues, such as climate change, in the management of their assets;
- Promoting further insurance leading practices based on informational materials, and in some cases, risk assessment tools to educate policyholders about climate risk;
- Promoting micro-insurance products that also support societal resilience;

From their part, Governments and Public Entities should promote insurance behavior, especially in those countries where this is not yet common.

6.4.3 Development of insurance and/or investment products and services

Property and casualty insurers , even though being at the "front line" of climate risks, do not typically address climate risks comprehensively and rather tend to limit coverage or withdraw from disaster-prone areas (like coastal regions) and shift responsibility and risks to local communities and public institutions.

Responsible and effective property and agriculture insurance companies should fully integrate natural disaster exposure zones in their practices.
At the regional level, the options for establishing a Mediterranean Catastrophe Risk Insurance Facility could be explored, taking into account the experience of the relevant Facility for the Caribbean. Regional risk management institutions and platforms could be established to foster collaborative action to coordinate the management of weather-related risks and build risk prevention and management capabilities.

6.4.4 Public sector role to create an enabling environment

The role of the public sector mainly lies on creating an enabling environment for enhancing adaptation through appropriate banking and insurance policies, products and services. This requires more integration of insurance needs and/or impacts into framework strategies such as sustainable development, national environmental protection and ICZM strategies to be established in accordance to the ICZM Protocol, with a particular focus on the management of setback zones (Article 8.2) and natural hazards (Article 22). Public-private partnerships should also be promoted for large-scale risk coverage in some coastal regions where insurance products do not cover climate change related risks.

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List of Abbreviations

CAF	Cancun Adaptation Framework
CIF	Climate Investment Funds
CIRCE	Climate Change and Impact Research: the Mediterranean Environment
CMIP	Coupled Model Intercomparison Project
COP	Conference of Parties
CORDEX	Coordinated Regional Climate Downscaling Experiment
CPEIR	Climate Public Expenditure and Institutional Review
CRI	Climate Risk Index
CVI	Climate Vulnerability Index
DRR	Disaster Risk Reduction
DRM	Disaster Risk Management
EbA	Ecosystems based Adaptation
EcAp	Ecosystems Approach
EEA	European Environment Agency
GAN	Global Adaptation Network
GCF	Green Climate Fund
GEF	Global Environment Facility
GIZ	Gesellschaft für Internationale Zusammenarbeit
GWP-Med	Global Water Partnership - Mediterranean
HELCOM	Helsinki Commission
ICZM	Integrated Coastal Zone Management
IPCC	Intergovernmental Panel on Climate Change
IPCC AR5	5th Assessment Report of the IPCC
JRC	Joint Research Centre
LAS	League of Arab States
LDCs	Least Developed Countries
MAP	Mediterranean Action Plan
MCSD	Mediterranean Commission on Sustainable Development
MDBs	Multilateral Development Banks
MDG	Millennium Development Goals
MEDEX	MEDiterranean EXperiment on "Cyclones that produce high impact weather in the Mediterranean"
MSSD	Mediterranean Strategy for Sustainable Development
NAPA	National Adaptation Programmes of Action
NWP	Nairobi Work Programme
OSPAR	Oslo and Paris Conventions
PAP/RAC	Priority Actions Programme / Regional Activity Centre
PB/RAC	Plan Bleu / Regional Activity Centre
PESETA	Projection of Economic impacts of climate change in Sectors of the European Union
PPCR	Pilot Programme for Climate Resilience
PSI	Principles for Sustainable Insurance
RCM	Regional Climate Model
RCP	Representative Concentration Pathways
SCCF	Special Climate Change Fund
SDG	Sustainable Development Goals
SEA	Strategic Environmental Assessment
SEE	South Eastern Europe
SIDA	Swedish International Development Agency
SIDS	Small Island Developing States
SLR	Sea Level Rise
SPA/RAC	Specially Protected Areas / Regional Activity Centre

SREX IPCC's Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation
SST Sea Surface Temperature
UfM Union for the Mediterranean
UN ESCWA United Nations Economic and Social Commission for Western Asia
UNCLOS United Nations Convention on the Law of the Sea
UNEP United Nations Environment Programme
UNEP ROWA UNEP Regional Office for West Asia
UNFCCC United Nations Framework Convention on Climate Change
WCRP World Climate Research Programme

Glossary of Terms

Adapted from: IPCC, 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
ICZM definition from the Protocol on Integrated Coastal Zone Management in the Mediterranean.

Adaptation:	The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects.
Climate change	Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use.
Climate-resilient pathway for development	A continuing process for managing changes in the climate and other driving forces affecting development, combining flexibility, innovativeness, and participative problem solving with effectiveness in mitigating and adapting to climate change. If effects of climate change are relatively severe, this process is likely to require considerations of transformational changes in threatened systems if development is to be sustained without major disruptions.
Climate variability:	Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).
Disaster risk management:	Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, and sustainable development.
Ecosystem Approach	A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. An ecosystem approach is based on the application of appropriate scientific methods, focused on levels of biological organization, which encompass the essential structure, processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems
Exposure:	The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.
Hazard:	The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.
Integrated coastal zone management (ICZM):	A dynamic process for the sustainable management and use of coastal zones, taking into account at the same time the fragility of coastal ecosystems and landscapes, the diversity of activities and uses, their

	interactions, the maritime orientation of certain activities and uses and their impact on both the marine and land parts.
Impacts:	Effects on natural and human systems of extreme weather and climate events and of climate change. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of climate changes or hazardous climate events occurring within a specific time period and the vulnerability of an exposed society or system.
Low regret measures	Low cost activities that yield benefits even in the absence of climate change. The implementation of these actions often constitutes a very efficient first step in a long-term adaptation strategy
Maladaptation	Actions that may lead to increased risk of adverse climate-related outcomes, increased vulnerability to climate change, or diminished welfare, now or in the future.
Resilience:	The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.
Risk:	The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard, following the IPCC AR5 WGII (2014).
Vulnerability:	The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt.