ADRIADAPT

Guidelines for mainstreaming of climate change adaptation into coastal management along Adriatic coasts

Deliverable 4.1.1

Work Package 4
Activity 4.1

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Guidelines for mainstreaming of climate change adaptation into coastal management along Adriatic coasts

Note:

These guidelines were prepared in 2020 within the frame of the INTERREG Adriadapt project (adriadapt.eu), to provide local authorities from the Croatian and Italian side of the Adriatic with a step-by-step process of preparing a coastal adaptation plan. The Guidelines build on the previously published PAP/RAC document "Guidelines for Adapting to Climate Variability and Change along the Mediterranean Coast", prepared in 2015 within the frame of ClimVar&ICZM project by Anil Markandya and Maria Snoussi.

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Publisher:	PAP/RAC, 2021
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Graphic design:	Slobodan Pavasović
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Acknowledgments:	Anil Markandya, Maria Snoussi, Chiara Castellani, Margaretha Breil, Lorenzo Bono, Brian Shipman, Željka Škaričić, IUAV and the rest of the AdriAdapt team

Please cite this document as:

PAP/RAC (2021) „Guidelines for mainstreaming of climate change adaptation into coastal management along Adriatic coasts", INTERREG AdriAdapt project

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List of Acronyms

ADEME	French Environment and Energy Management Agency
AViTeM	Agency for sustainable Mediterranean cities and territories
AR5	Fifth Assessment Report
CAMP	Coastal Area Management Programme
CAP	Common Agricultural Policy
CBD	Convention on Biological Diversity
CEF	Connecting Europe Facility
CF	Cohesion Fund
CFP	Common Fisheries Policy
CIRCE	Climate Change and Impact Research the Mediterranean Environment
ClimVar	Climate Variability
COP	Conference of Parties
DIVA	Dynamic and Interactive Vulnerability Assessment
DRR	Disaster Risk Reduction
EAFRD	European Agricultural Fund for Rural Development
EbA	Ecosystems-Based Adaptation
EC	European Commission
EEA	European Environment Agency
EIB	European Investment Bank
EMFF	European Maritime and Fisheries Fund
ERDF	European Regional Development Fund
ETC-CCA	European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation
EU	European Union
EUSAIR	EU Strategy for the Adriatic and Ionian Region
FP	Framework Programme
GEF	Global Environment Facility
GHGs	Greenhouse Gases
ICZM	Integrated Coastal Zone Management
IMF	Integrative Methodological Framework
IOC-UNESCO	Intergovernmental Oceanographic Commission of UNESCO
IPCC	Intergovernmental Panel on Climate Change
IWRM	Integrated Water Resources Management
KIC	Knowledge and Innovation Community
MAP	Mediterranean Action Plan
MedECC	Mediterranean Experts on Climate and Environmental Change
MedPartnership	Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (LME)
MFF	Multi-annual Financial Framework
MSFD	Marine Strategy Framework Directive
MSSD	Mediterranean Strategy on Sustainable Development
MSP	Marine Spatial Planning
NICZM	National Integrated Coastal Zone Management
NGO	Non-Governmental Organization
NOAA	National Oceanographic and Atmospheric Administration
NUTS	Nomenclature of territorial units for statistics
NWRM	Natural Water Retention measures
OECD	Organization for Economic Cooperation and Development
PAP/RAC	Priority Actions Programme / Regional Activity Centre
PCA	Protected Coastal Area
PEGASO	People for Ecosystem-Based Governance in Assessing the Sustainable Development of Ocean and Coast
PNACC	National Plan for Climate Change Adaptation (Italian)
PON	National Operational Programme (Italian)
POR	Regional Operational Programme (Italian)
PPPs	Public-Private-Partnerships
PSI	Private Sector Initiative
RAC	Regional Activity Centre
RC	Resilient Cities
RCP	Representative Concentration Pathway
SEA	Strategic Environmental Assessment
SEI	Stockholm Environment Institute
SLR	Sea-Level Rise
SNAC	National Strategy for Climate Change Adaptation (Italian)
SRES	Special Report on Emissions Scenarios
UfM	Union for the Mediterranean
UfM CCEG	Union for the Mediterranean Climate Change Expert Group
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations International Strategy for Disaster Reduction
WFD	Water Framework Directive
WMO	World Meteorological Organization
WP	Work Package

Background information

AdriAdapt – a resilience information platform for Adriatic cities and towns, is a collective effort of six Italian and five Croatian partners aiming to promote local and regional resilience by developing the knowledge base required to identify suitable climate adaptation and planning options, thereby enabling local authorities to respond to policy needs related to climate action in urban and coastal zones of the project area.

The AdriAdapt Project is structured in five working packages (WPs), where within WP4 and WP5 several thematic and strategic guidelines for local and regional authorities were developed. These publications will serve as the backbone of the future knowledge platform. An expert meeting between all the Adriadapt partners responsible for all WPs was organized by PAP/RAC in Split in June 2019 in order to harmonize the approaches and secure efficient collaboration for WP4 and WP5. The "Guidelines for mainstreaming of adaptation into coastal management along Adriatic coasts" document builds on the previously published PAP/RAC document "Guidelines for Adapting to Climate Variability and Change along the Mediterranean Coast". This document takes the reader through a stage-by-stage process of preparing a plan.

In the first stage entitled "Establishment" the publication presents the legal and policy framework for adaptation along the coastal zones. In the second stage of analysis it introduces the climate challenges and future projections, including impacts on sectors. The publication leads the reader through "Setting the vision" stage, "Designing the future" and "Realizing the vision".

These Guidelines represent the backbone for the knowledge management platform to be produced for the Adriadapt project and will be complemented with the information provided in the knowledge base. PAP/RAC and the expert engaged, Mr. Emiliano Ramieri, tried to merge the principles of Climate Adapt Adaptation Support Tool and the ICZM Process through this publication.

Objective and Structure of the Report

Aim of the Report

The aim of these guidelines is to provide planners and policy-makers in Croatia and Italy with guidelines to mainstream climate action into management of coastal regions, including:

- An overview of the impacts of climate variability and change on coastal zones,
- Information on how to focus integrated coastal zone management (ICZM) on climate action,
- Lessons learned from the experience of handling climate variability and change in specific locations.

These guidelines were developed as a part of the Activity 4.1 "Tools and strategies for a climate resilience knowledge base in the Adriatic" of the ADRIADAPT project. This activity falls under the Working Package 4 of the Project, which aims to provide selected, user-friendly information for the Adriatic cities and regions and all other relevant stakeholders in form of good practices, guidelines and studies that will support diagnosis and policy solutions for local resilience.

In terms of background material, the document draws on an earlier report "Guidelines for Adapting to Climate Variability and Change along the Mediterranean Coast" (UNEP/MAP/PAP, 2015), prepared within the frame of the ClimVar&ICZM Project. Building on that report, the present guidelines provide a detailed understanding of different key aspects of climate variability and change in the Mediterranean coastal zones, with a special focus on Croatia and Italy, and aid in interpreting the climate change dimension with regard to the format, content and provisions of the Integrated Coastal Zone Management (ICZM) process[1]. The stages of the ICZM process, which originate from typical planning process, are also applicable when developing coastal adaptation plans (Figure 1).

Figure 1: Stages of the ICZM process

[1] The ICZM process has been presented in three related documents prepared by the PAP/RAC: "Guidelines for the Preparation of National ICZM Strategies Required by the Integrated Coastal Zone Management (ICZM) Protocol for the Mediterranean" (2011); "Toward Converging Management Approaches for Mediterranean Coastal Zones: An Integrated Methodological Framework for Coastal, River Basin and Aquifer Management" (2012) – IMF Document; and "The ICZM process" (http://www.coastalwiki.org/wiki/The_ICZM_Process_-_a_Roadmap_towards_Coastal_Sustainability_-_Introduction).

Table 1: Consideration of climate change elements in the ICZM Structure

Stage of ICZM process	Issues Addressed in this Report	Comment
1. **Establishment:** Setting out the ICZM plans within the context of the ICZM Protocol.	Introduction to international legal and policy framework to address the climate change issues.	What are the legal requirements for dealing with climate change? Who is responsible for what? How can the different levels be integrated?
2. **Analysis and Futures**: Building the evidence and identifying the futures.	Introduction to climate science and practice to explain the need for mainstreaming climate change into the planning processes. Presentation of current climate change on Adriatic coastal zones as well as future projections and expected impacts for major economic sectors (e.g.. tourism, agriculture, fisheries, etc.) and on coastal populations.	Provide the latest evidence on climate science in coastal zones in the Adriatic. Provide the latest results of climate change impacts on the main sectors (human and economic) and their future projections. Explain the reasons why climate change should be included in the planning processes.
3. **Setting the Vision**: Engage stakeholders in setting priorities and agreeing on key policies and measures.	Introduction to inclusive governance and presentation of resilience-building approaches and initiatives for coastal communities.	How to build a resilient strategy in a participatory manner, taking account of existing governance structures.
4. **Designing the Future**: Formulating plans to deal with climate impacts and establishing a management structure.	Presentation of vulnerability assessment approaches and proofing methodologies. Explanation of climate change adaptation approaches and provision of practical examples of good responses from the Adriatic and elsewhere (including lessons learned from local experiences).	Discuss approaches to assess vulnerability and provide examples of their application. Provide a list of the main adaptation policies and measures that have been identified for coastal zones.
5. **Realising the Vision:** Implementing the strategy.	Introduction to climate change-related financial aspects.	Steps to be taken to implement the plan and related legal issues. Different financial channels for mobilising resources to implement the selected policies and measures.

Before discussing the details of the steps based on the ICZM process, it is important to know the legal and policy framework that countries face when dealing with climate change and variability. This section begins by laying out that framework.

Introduction to the legal and policy framework

The countries of the Adriatic Basin face a variety of shared coastal and marine environmental problems that are trans-boundary in nature. The key to success in addressing these trans-boundary environmental and socio-economic concerns, especially the climate change issue, is mutual political commitment by all the countries of the basin. There is a widespread agreement that a "business as usual approach" is no longer a valid option to ensure the sustainability of coastal and marine resources, especially in the context of climate change, and that there is a need to revise existing policies, laws and strategies at the international, national and local levels in an integrated and participatory way to be more effective in coping with climate change.

This section explores the legal and policy frameworks that currently exist at the international (global), regional (Mediterranean), EU and national/ local levels, and that explicitly address climate change impacts on coastal management and related adaptation.

International legal frameworks

Conventions of global significance

Many global conventions and treaties that Italy and Croatia have signed have important repercussions for future coastal management and adaptation strategies in their region.

The main multilateral agreements that address climate change and coastal zones include:

- The 1992 ***UN Framework Convention on Climate Change (UNFCCC)***[2], which established an overall framework for intergovernmental efforts to tackle the challenges posed by climate change. UNFCCC is the first binding international legal instrument to address the climate change issue. It was opened for signature in Rio de Janeiro at the June 1992 UN Conference on Environment and Development (UNCED) and entered into force on 21 March 1994.
- The ***Convention on Biological Diversity (CBD)***[3] has a specific mandate for marine and coastal diversity (Jakarta, 1995). The COP 10 of the CBD (Decision X/29 (7)) "invites parties… to further integrate cl*imate change-related aspects of marine and coastal biodiversity into relevant national strategies, action plans and programmes, including, inter alia, national integrated marine and coastal management programmes".* At a regional level, objectives of the CBD are being promoted both by the Mediterranean state signatories through various work programmes and within the European Union through implementation of the Natura 2000 network at the Mediterranean state level.

Mediterranean Conventions policy frameworks

United Nations Environment Programme (UNEP) – Regional Seas Programme: The Mediterranean Action Plan (MAP)

In 1975, the United Nations Environment Programme Mediterranean Action Plan (UNEP MAP) became the first plan adopted as a Regional Seas Programme under the UNEP umbrella. **The Barcelona Convention** (*The Convention for the Protection of the Mediterranean Sea against Pollution)* and its protocols form the legal framework of the Mediterranean Action Plan.

The Barcelona Convention was signed in 1976, entered into force in 1978 and was revised in 1995

[2] www.unfccc.int
[3] https://www.cbd.int/doc/legal/cbd-en.pdf

and renamed the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean[4]. The Barcelona Convention has gradually expanded its scope of action through seven protocols that address specific aspects of Mediterranean environmental conservation, including protocols on specially protected areas and biological diversity, hazardous wastes and ICZM.

Implemented by the Barcelona Convention, MAP introduced integrated coastal zone management in the mid-1980s in response to the growing development pressure in coastal areas. A series of policy documents, recommendations, programmes and projects, such as Coastal Area Management Programmes (CAMPs)[5], and tools and instruments have been developed and implemented through the six MAP Regional Activity Centres (RACs) based in Mediterranean countries.

The main declarations adopted by various conferences of parties to the Barcelona Convention that specifically mention climate change and the coastal zones are the ***Almeria Declaration[6], the Marrakech Declaration[7],*** and ***the Protocol on Integrated Coastal Zone Management*** *in the Mediterranean (ICZM Protocol) of the Barcelona Convention[8]*. The Protocol was signed in Madrid on 21 January 2008 and entered into force on 23 March 2011. It is the first regional coastal zone management legal instrument that deals extensively with the issue of climate change, both at the strategic level (by requesting countries to mainstream climate change issues into national strategies and plans) and the local level (by requesting countries to define, *inter alia*, the coastal setback zone). Croatia ratified the ICZM Protocol with its national law in 2013, while Italy hasn't ratified it yet. PAP/RAC is the centre in charged with providing support in implementing the Protocol on the Integrated Coastal Zone Management (ICZM Protocol).

Mediterranean Strategy for Sustainable Development (MSSD)

The first Mediterranean Strategy for Sustainable Development (MSSD), adopted in 2005, included the mitigation of climate change and adaptation to its effects as one of its seven priority fields of action. The assessment of the implementation of the MSSD report in 2011suggested that the revised MSSD should put more emphasis on orientations, actions and indicators concerning emerging priorities, such as adaptation to climate change. The revised MSSD for 2016-2025 period now includes specific objective on climate change (*Objective 4: Addressing climate change as a priority issue for the Mediterranean*).

[4] http://195.97.36.231/dbases/webdocs/BCP/bc95_Eng_p.pdf
[5] http://www.paprac.org/
[6] http://www.emwis.net/documents/PDF/Almeria%20Declaration
[7] http://unfccc.int/cop7/documents/accords_draft.pdf
[8] http://www.unepmap.org/index.php?module=news&action= detail&id=110

Box 1: Articles of the ICZM Protocol that Address climate variability and change

- Taking risk into account in the implementation of ICZM (Art. 5e)
  "The objectives of integrated coastal zone management are to: (...) prevent and/or reduce the effects of natural hazards and in particular of climate change, which can be induced by natural or human activities" (Art. 5e).
- Integrating the "risk" dimension in the ICZM national strategy (Art. 22)
  "Within the framework of national strategies for integrated coastal zone management, the Parties shall develop policies for the prevention of natural hazards" (Art. 22).
- Part IV of the protocol addresses "Risks Affecting the Coastal Zone", calling on parties *to take measures to prevent and mitigate natural hazards and climate change in particular, as well as coastal erosion (Art. 22–24).*

Tools for integrating risks in coast-related sectoral policies:

- Establishing a coastal setback zone (Art. 8-2)
- Vulnerability and hazard assessments (Art. 22)
- Adopting prevention, mitigation and adaptation measures (Art. 22, 23-1)
- Respecting carrying capacity as a tool for preventing risk (Art. 6b)

Regional Adaptation Framework for Climate Change

The focus of the Framework, coherently with the legal framework set by the Protocols of the Barcelona Convention, is on the marine and coastal environments of 21 countries that border the Mediterranean Sea.

Following the endorsement of the Framework by the Contracting Parties to the Barcelona Convention at their 19th Ordinary Meeting in 2016 the UN Environment MAP system offers it to policy makers and stakeholders in the Mediterranean region as a structured outline to facilitate the identification of strategic objectives, strategic directions and priorities for adapting to climate change.

The Union for the Mediterranean (UfM)

The Ministers of Environment and Climate Change of the Union for the Mediterranean Member States approved the UfM Ministerial Declaration on Environment and Climate Change on 13 May 2014 in Athens, which included climate change for the first time as a priority area of cooperation.

In this context, the Ministerial Declaration established the UfM Climate Change Expert Group (UfM CCEG), created to act as the main climate policy dialogue platform in the Mediterranean. The UfM CCEG showcases how a complex system of relevant initiatives, programmes and structures can be brought together in order to create synergies while including government representatives, civil society, scientific experts, private sector, international financial institutions as well as other relevant stakeholders.

MedECC

The Mediterranean Experts on Climate and Environmental Change (MedECC) network, created in 2015, is based on an open and independent international scientific expert network acting as a mechanism of on-going support for decision-makers and the general public on the basis of available scientific information and on-going research. The construction of this network responds to several intentions of regional institutions, such as the UN Environment/MAP through the MSSD 2016-2025 and the Regional Framework for Climate Change Adaptation in the Mediterranean, and the Expert Group on Climate Change of the Union for the Mediterranean (UfM CCEG).

MedECC includes more than 600 scientists from 35 countries and covers all major geographical sub-regions of the Mediterranean area.

EU policy on climate change adaptation

The EU Strategy on Adaptation to Climate Change

The EU Strategy on Adaptation to Climate Change[9] is the main policy instrument of the EU focusing on adaptation to a changing climate. Following the "EU White Paper on Adaptation"[10], the European Commission adopted this strategy in 2013, with the overall aim of contributing to a more climate-resilient Europe. This means enhancing the preparedness and capacity to respond to the impacts of climate change at local, regional, national and EU levels, developing a coherent approach and improving coordination. The strategy is structured around the following three objectives:

1. Promoting action by Member States in order to achieve coordination and coherence at the various levels of planning and management.
2. Better informing decision-making by improving adaptation knowledge.
3. "Climate-proofing" EU action by mainstreaming adaptation measures into EU policies and programmes and promoting adaptation in key vulnerable sectors.

The implementation of these objectives is based on the following eight actions:

1. Encourage all Member States to adopt comprehensive adaptation strategies.
2. Provide LIFE funding to support capacity building and step up adaptation action in Europe.
3. Introduce adaptation in the Covenant of Mayors framework.
4. Bridge the knowledge gap.
5. Further develop Climate-ADAPT as the 'one-stop shop' for adaptation information in Europe.
6. Facilitate the climate-proofing of the Common Agricultural Policy (CAP), the Cohesion Policy and the Common Fisheries Policy (CFP).
7. Ensure more resilient infrastructure.
8. Promote insurance and other financial products for resilient investment and business decisions.

Box 2: The European Climate Adaptation Platform (Climate-ADAPT)

Launched in 2012, Climate-Adapt is a partnership between the European Commission and the European Environment Agency to support Europe in adapting to climate change and to overcome the lack of a consistent knowledge base on adaptation in Europe. Climate-Adapt is recognized by the EU Strategy on Adaptation to Climate Change as a key element for better-informed decision-making and emphasizes its potential to act as the 'one-stop shop' for adaptation information in Europe (Action 5).

Its intended target audience includes governmental decision-makers and the organizations supporting them in the development, implementation and evaluation of climate change adaptation strategies, plans and actions at EU, transnational, national and sub-national levels. Climate-ADAPT users can access and share data and information on:

- Expected climate change in Europe,
- Current and future vulnerability of regions and sectors,
- EU, national and transnational adaptation strategies and actions,
- Adaptation case studies and potential adaptation options,
- Tools that support adaptation planning.

[9] COM(2013) 216 final. An EU Strategy on adaptation to climate change. 16.04.2013.
[10] COM(2009) 147/4. White Paper. Adapting to climate change: towards a European framework for action.

A process of progressive evaluation of the Strategy was established to report to the European Parliament and the Council on the state of implementation and propose a review, if needed. The evaluation report issued in 2018, finds that the strategy has delivered on its objectives[11].

Progress has been recorded against each of its eight individual actions. Nevertheless, the evaluation outlines that Europe is still vulnerable to climate impacts within and outside its borders and suggests areas where more work needs to be done to address vulnerable regions and sectors. The areas on which the Strategy is expected to deliver more in the future for example include:

- integration between adaptation and disaster risk reduction,
- better integration of adaptation in the EU maritime and fisheries policy and coastal areas in general,
- using private investment in adaptation,
- ecosystem-based adaptation,
- adoption and monitoring of local adaptation strategies and actions,
- assessment and mapping of social vulnerability to climate-related events,
- promoting stronger links between adaptation and mitigation policies.

Other EU policies and directives

Besides the EU Strategy on Adaptation to Climate Change, other coastal and marine policies address the issue of adaptation, mainly indirectly.

Since its creation in 2007, the *Integrated Maritime Policy*[12] seeks to provide a more coherent and integrated approach to maritime issues, with better coordination between different policy areas. It aims to enhance Europe's capacity to face a number of challenges posed by an increasing use of the sea, in a context of rapid globalisation and climate change.

Its environmental pillar, the *Marine Strategy Framework Directive* (MSFD)[13] aims to deliver a "Good Environmental Status" of the marine environment by 2020. To achieve this goal, each Member State is required to develop a Marine Strategy to be periodically reviewed according to an adaptive and flexible management approach, considering the dynamic nature of the marine environment and the variability of the pressures exerted by human activities and climate change.

In addition, the *Common Fisheries Policy*[14], which has been reformed since 2014, supports the long-term sustainable development of the maritime and fisheries in a context of climate change. The European Maritime and Fisheries Fund (EMFF) supports the European fisheries sector towards more sustainable fishing practices and a specific guidance[15] was issued to ensure that climate change adaptation objectives are embedded in the design of the 2014-2020 EMFF Operational Programmes. Furthermore, within the new programming period (2021-2027), an expected significant contribution of EMFF budget will be given to climate change mitigation and adaptation, coherently with some of the results highlighted by the evaluation of the EU Strategy on Adaptation to Climate Change.

The *Maritime Spatial Planning (MSP) Directive*[16], adopted in 2014, 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. Each Member State is called to elaborate maritime spatial plans by March 2021. Climate change is mentioned in the preamble and in the objectives of the directive, stating that Member States should seek to improve

[11] COM(2018) 738 final. Report on the implementation of the EU Strategy on adaptation to climate change. 12.11.2018

[12] COM(2007) 574 final. An Integrated Maritime Policy for the European Union. 10.10.2017. See also https://ec.europa.eu/maritimeaffairs/policy_en

[13] Directive 2008/56/EC, establishing a framework for community action in the field of marine environmental policy

[14] https://ec.europa.eu/fisheries/cfp_en

[15] SWD(2013) 299 final. Principles and recommendations for integrating climate change adaptation considerations under the 2014-2020 European Maritime and Fisheries Fund operational programmes. 30.7.2013.

[16] Directive 2014/89/EU establishing a Framework for Maritime Spatial Planning.

the resilience to climate change impacts through their maritime spatial plans.

In coastal areas, the *Water Framework Directive* (WFD)[17]. covers transitional and coastal waters up to one nautical mile from the territorial baseline of a member state for the achievement of the "Good Ecological Status" and up to 12 nautical miles for a "Good Chemical Status". Although climate change is not explicitly included in the text of the WFD, the cyclical approach of the river basin management planning process makes it well suited to adaptively manage climate change impacts. A specific guidance (River basin management in a changing climate; EC, 2009) has been issued by the European Commission to support river basin managers in incorporating climate change in the river basin management plans.

The *Floods Directive*[18] devotes attention to the impact of coastal floods, considering that climate change could cause greater "likelihood and adverse impacts of flood events". According to the directive, climate change should be addressed in the Preliminary flood risk assessments and in the Flood Risk Management Plans, in a process of periodical revision and updating.

Finally, the *Habitats*[19] *and Birds Directives*[20] provides the legal framework of the Natura 2000 network, which protects a large percentage of coastal and marine regions in Europe. In 2013, the European Commission produced the "Guidelines on Climate Change and Natura 2000" (EC, 2013) which were intended for site managers and policy-makers. The guidelines focus on practical advice and 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.

EU Strategy for the Adriatic and Ionian Region (EUSAIR)

The EUSAIR Region is a functional area primarily defined by the Adriatic and Ionian Sea basin, including four EU member states (Croatia, Greece, Italy and Slovenia) and four non-EU countries Albania, Bosnia and Herzegovina, Montenegro and Serbia. The general objective of the EU Strategy for the Adriatic and Ionian Region and its Action Plan[21] is to promote economic and social prosperity and sustainable growth in the Adriatic and Ionian Region by improving its attractiveness, competitiveness and connectivity. The EUSAIR focuses on both the land and marine resources of the region and fully incorporates the contents of the previous Maritime Strategy for the Adriatic and Ionian Seas[22]. The strategy builds on four thematic pillars:

- Blue growth,
- Connecting the Region,
- Environmental quality,
- Sustainable tourism.

Climate change features as a horizontal topic relevant to all four pillars of the EUSAIR strategy.

The Strategy recognizes that the region is vulnerable to disasters and to the impact of climate change, emphasizing the need of joint cooperation to undertake adaptation and disaster risk reduction actions to favour the sustainable development of the region.

[17] Directive 2000/60/EC, establishing a framework for Community action in the field of water policy.
[18] Directive 2007/60/EC on the assessment and management of flood risks.
[19] Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
[20] Directive 2009/147/EC on the conservation of wild birds.
[21] https://www.adriatic-ionian.eu/.
[22] COM(2012) 713 final. A Maritime Strategy for the Adriatic and Ionian Seas. 30.11.2012.

National legal frameworks

Legislative framework – Italy

In Italy, the *National Strategy for Climate Change Adaptation* (SNAC, 2015)[23] was approved and adopted in 2015, after a process of public consultation. The strategy is based on a previous work coordinated by the Italian Ministry for the Environment, Land and Sea Protection, that led to the publication of three documents (Castellari *et al.*, 2014a, b, c) about:

- the scientific knowledge status on impacts, vulnerability and adaptation in Italy,
- the analysis of the legislation framework at EU and national level, and
- the elements for a national strategy, identifying strategic objectives and actions.

The main objective of the Italian Strategy on Climate Change Adaptation is to develop a national vision on the possible actions to be taken to deal with climate change by contrasting and adapting to its impacts. The strategy identifies actions and guidelines to minimize the risks deriving from climate change, to protect health, well-being and the assets of the population, to preserve the natural heritage, to maintain or improve the resilience and adaptability of natural, social and economic systems as well as to take advantage of any opportunities that may arise with the new climatic conditions. Five pillars of strategic actions were established to:

1. improve current knowledge on climate change and its impacts,
2. describe the vulnerability of the territory, the adaptation options for all the natural systems and for all the relevant socio-economic sectors, identifying any associated opportunities,
3. promote participation and increase awareness of stakeholders in defining sectoral strategies and adaptation plans through a wide communication and dialogue process, also in order to mainstream adaptation into sector policies more effectively,
4. support awareness-raising and information on adaptation through a widespread communication activity on the possible impacts, risks and opportunities arising from climate change,
5. select the tools to be used to identify the best options for adaptation actions, also highlighting the co-benefits.

The strategy, after stating its objectives and key principles analyses the vulnerability of Italy in the European and Mediterranean context and describes the expected impacts of climate change on different sectors, including marine and coastal ones. The strategy finally defines sector and cross-sector actions to be further evaluated in the upcoming National Adaptation Plan. Actions are categorised in societal, green and grey solutions, with a short- and long-term perspective.

The *National Plan for Climate Change Adaptation* (PNACC)[24] is currently available as a first draft (2017), which was submitted to public consultation. The document is the result of a process of dialogue, involvement and multi-sectoral interactions among different institutions, policy makers, experts and researchers, with the ultimate goal of identifying a set of connected and synergistic activities for adaptation to climate change.

It is designed to be a flexible instrument, open to a continuous updating process from new knowledge and experience gained during its implementation. The PNACC aims to support the implementation of the National Strategy, offering a support tool to national, regional and local institutions for identifying and choosing the most effective actions in different climatic areas. The general objective of the Plan is split in three specific objectives:

- limiting the vulnerability of natural, social and economic systems to the impacts of climate change,
- increasing their adaptation capacity, improving the exploitation of any opportunities, and

[23] https://www.minambiente.it/pagina/adattamento-ai-cambiamenti-climatici-0

[24] https://www.minambiente.it/pagina/consultazione-su-piano-nazionale-adattamento-cambiamenti-climatici

- facilitating the coordination of actions at different levels.

The first part of the document includes a detailed analysis of the current knowledge on past trends, scenarios, vulnerability and impacts of climate change in Italy. To this aim, a zonation of the national territory was proposed, based on past climatic conditions (1987-2010 as reference period) and on future projections of climatic anomalies.

In the second part of the document, more than 350 adaptation actions are proposed. Actions are presented by single sector, referred to specific impacts of climate change and associated to the previously identified homogeneous areas for past and future climate conditions. A clear prevalence of non-structural measures (societal) emerges from the analysis of the proposed actions, followed by actions based on an ecosystem approach (green) and then by infrastructural and technological measures (grey). Societal actions are evenly distributed over almost all sectors, while the green type appears to prevail in the forest sector. A substantial balance between the three types of action characterizes the coastal zone sector.

Several sub-national initiatives have been started across Italy in recent years. Regional strategies were approved in some Italian regions, such as Emilia Romagna[25] (regional resolution 187/2018), Lombardia[26] (regional resolution 86/2015 followed by the approval of a document for regional action for adaptation) and Sardinia[27] (regional resolution 6/50/2019). Other Italian regions are being in the process of adaptation through the elaboration of preparatory strategic documents. Examples include the Abruzzo[28] Region that approved a programmatic document aimed to prepare a Plan for adaptation for climate change (2015) and Piemonte Region[29] that in 2017 concretely started the process of adaptation providing the first strategic indications to prepare a regional strategy on climate change (regional resolution 24-5295/2017).

Regarding the **legislation on coastal planning**, a national strategy for the Integrated Coastal Zone Management has not yet prepared in Italy. However, several legislative acts, both at national and at subnational level, define planning and programming activities to protect the coast.

Special consideration to the coast was firstly assigned by the national law n. 431/1985. This law regulates landscape protection in general and as far as coastal areas are concerned it identifies a 300 m strip subjected to landscape restrictions, partly contrasting the growing anthropization of the natural environment. The national legislative decree establishing an environmental code for Italy (n. 152/2006, with amendments) defines actions to ensure the protection and recovery of soil and subsoil, specifically including the protection of coastal areas and coastal settlements from marine flooding and erosion. Finally, the national guidelines for maritime spatial planning and management (D.P.C.M. 1/12/2017) widely refer to ICZM as a process to be integrated with MSP, aiming to strengthen coherence between land and sea planning.

In the past, many Italian regions facing the sea have started and conducted several studies on coastal dynamics and coastal risks and have carried out numerous works aimed at improving coastal defence. Indeed, main competences for coastal management have progressively shifted from the State to the regions, which, in several cases started developing coastal strategies or plans, defining guidelines and interventions for coastal protection and regulating human activities in the coastal areas.

[25] https://ambiente.regione.emilia-romagna.it/it/cambiamenti-climatici/materiali-vari/documenti_vecchia_versione/strategia-regionale-per-i-cambiamenti-climatici

[26] http://www.regione.lombardia.it/wps/portal/istituzionale/HP/DettaglioRedazionale/servizi-e-informazioni/cittadini/Tutela-ambientale/Qualita-dell-aria/adattamento-al-cambiamento-climatico-verso-una-strategia-regionale/adattamento-al-cambiamento-climatico-la-strategia-regionale

[27] https://portal.sardegnasira.it/mitigazione-e-adattamento

[28] https://www.regione.abruzzo.it/content/pacc-abruzzo-resilienza-e-politiche-di-adattamento-ai-cambiamenti-climatici

[29] http://relazione.ambiente.piemonte.it/2018/it/clima/risposte/strategia-adattamento

Considering Italian regions with coasts bordering the Adriatic Sea, relevant initiatives towards ICZM include the followings (MATTM-Regioni, 2018):

- Veneto adopted guidelines (regional decrees 898/2016 1215/2014 and 2541/2012) to define interventions of coastal protection and nourishment providing a regional intervention strategy within the ICZM framework.
- Emilia Romagna supports ICZM through its regional law 17/2004 concerning interventions for coastal defence and approved regional guidelines for ICZM in the region (regional decree 645/2005).
- Marche approved an ICZM plan (regional decree 675/2019), following the requirements of the regional law 15/2004 and the previously adopted guidelines.
- Abruzzo approved a planning document for risk management of the vulnerable areas within the ICZM framework (regional decree 964/2002), with an update of risk analysis approved in 2017 (regional decree 841/2017).
- Puglia approved a Regional Plan of the coasts (regional decree 2273/2011) framing the knowledge state, define coastal uses and also establishing criteria for drafting plans at municipal level.

About climate change mitigation, considering its complementarity with adaptation policies and measures, the Italian efforts follow the commitments undertaken with the Kyoto Protocol (2008-2012), its Doha Amendment (2013-2020) and the Paris Agreement. Italy set out its vision in the National Sustainable Development Strategy (2017[30]) and the Italian National Energy Strategy (2017[31]) which specifically define Italy roadmap for the decarbonisation of its economy up to 2030 and beyond. A proposal of an Integrated Plan for Energy and Climate was draft in 2018[32] and it is aimed to a progressive decarbonisation, a shift towards the renewable energy sources and improvement of energy efficiency.

Legislative framework – Croatia

With the Decision of the Government in accordance with the Air Protection Act (Official Gazette 130/11, 47/14, 61/17) the Committee for inter-sectoral coordination of policies and measures for mitigation and adaptation to climate change was established in 2014. The Committee, consisting of representatives of competent state administration bodies and other relevant institutions, agencies and non-governmental organizations, was in charge for monitoring and evaluation of the implementation and planning of policies and mitigation and adaptation measures for climate change in the Republic of Croatia.

In 2017 the White Paper of the National Climate Change Adaptation Strategy for the period up to 2040 with a view to 2070 and the draft Action Plan were drawn up, which resulted in the adoption of the final document of the Strategy on 7 April 2020 by the Croatian Parliament (Official Gazette, no. 46/20). The general goals of the Strategy are:

- to raise awareness of the importance of climate change and the inevitable launch of the adaptation process in all social segments,
- to bring together all relevant institutional, political, economic and social stakeholders to create strong enough support for the implementation of joint actions on the implementation of adaptation measures, which necessitates a proactive approach,
- to integrate the adaptation process, including the implementation of measures, into existing and new policies, programs, plans and other activities implemented at all levels of governance,
- to stimulate or enhance scientific research to better understand the complexity of climate change impacts and reduce the degree of uncertainty related to the effects of climate change, and
- to reduce the vulnerability of social and natural systems to the adverse impacts of climate.

[30] https://www.minambiente.it/pagina/la-strategia-nazionale-lo-sviluppo-sostenibile
[31] https://www.mise.gov.it/images/stories/documenti/Testo-integrale-SEN-2017.pdf
[32] https://www.minambiente.it/sites/default/files/archivio/proposta_di_piano_nazionale_integrato_per_energia_e_il_clima_italiano.pdf

In order to efficiently use adaptation actions for mitigation, a legal framework for mitigation is here briefly introduced: The Republic of Croatia has prepared a Draft of the Low-carbon Development Strategy of the Republic of Croatia by 2030 with a view to 2050. It is a multi-sectoral development strategy and a base for emission reduction by sectors in line with European strategic guidelines and UNFCCC commitments. Also, the new Energy Development Strategy of the Republic of Croatia is in the process of preparation.

As for the **legislation on coastal planning**, its backbone in Croatia is the Physical Planning Act (Official Gazette 153/13, 65/17), which envisages preparation spatial plans for the terrestrial and area marine (up to the external limit of territorial waters). Spatial plans in Croatia are binding, with the status of the subordinate regulations. The Protected Coastal Area (PCA) (Art. 45-49.f), defined by the Act, would be of special interest for coastal adaptation, as a zone of special State interest, encompassing the area of coastal cities and municipalities. Within that zone, and in order to ensure protection and sustainability of development and planning, restricted area covering 1000 m wide continental belt (both on terrestrial part and islands) and 300 m wide sea belt, measured from the coastline, is established. Furthermore, additional limitations are determined for building within 100 m from the coastal line.

In 2014, Croatia started the preparation of the Strategy for the Management of the Marine Environment and Coastal Zone, integrating requirements of the two legal documents, i.e. MSFD and the ICZM Protocol.

The preparation of the Strategy was coordinated by the Ministry of Environment and Energy with the technical support of the Institute of Oceanography and Fisheries, the Faculty of Economics of the University of Split and the Priority Actions Program – Regional Activity Centre (PAP/RAC) of the UNEP-MAP. In the preparation of the Strategy, other relevant Ministries and institutions were also involved, in particular the Ministry of Construction and Physical Planning with the Croatian Institute for Spatial Development and the Ministry of the Sea, Transport and Infrastructure. The Strategy itself is composed of number of assessment documents and action programmes. The Monitoring and observation programme[33] was adopted in 2014 and the Program of measures for protection and management of the marine environment and the coastal area of the Republic of Croatia, as the most comprehensive document addressing land-sea interactions, was adopted by the Government in 2017 (Official Gazette 97/17). By adopting the Program of measures (September 2017), the first cycle of drafting the documents of Management Strategy for Marine Environment and Coastal Areas of the Republic of Croatia was completed.

On a sub-national level it is important to mention the Coastal Plan for Šibenik-Knin County. It was developed by PAP/RAC and Plan Bleu as part of the UNEP/MAP project "Integration of Climatic Variability and Change into National Strategies to Implement the Protocol on ICZM in the Mediterranean" (ClimVar & ICZM), within the framework of the MedPartnership initiative. The Plan proposes a vision for the desirable future of the Šibenik-Knin County coastal zone as well as key management policies and measures. Its main focus is on resilience and adaptation to climate change, coastal water management and sustainable spatial development. Measures to improve adaptation to climate change of sectors coastal and maritime tourism, aquaculture, biodiversity preservation and measures for coastal protection, are identified by the Plan. It was finalised in 2015 and adopted by the County Assembly in April 2016.

In 2019, Šibenik-Knin County's Coastal Plan was awarded with the "Mediterranean Climate Change Adaptation Award", organised by the French Environment and Energy Management Agency (ADEME), with the support of its Mediterranean partners: the Union for the Mediterranean (UfM), Plan Bleu and the Agency for sustainable Mediterranean cities and territories (AViTeM).

[33] http://www.mzoip.hr/doc/sustav_pracenja_i_promatranja_za_stalnu_procjenu_stanja_jadranskog_mora.pdf.

1. Establishment

1.1 Establishing co-ordination mechanisms

Steps in the establishment process

The above legal and policy framework provides a basis for the establishment phase. The assumption is that coastal adaptation plans should be comprehensive – covering all issues crucial for sustainable coastal development in the 21st century, and integrated – ensuring institutional co-ordination on all levels, the involvement of non-governmental organisations and other competent organisations and support of scientific institutions, as well as the integrity of sea and land areas. All partners should agree on the final status of the plan at this initial stage, particularly when the plan is being used to meet the statutory purposes of one or more sectors.

As far a climate change is concerned, the main task is to ensure institutional coordination with bodies responsible for climate adaptation plans. All countries have an obligation to produce a report to the UNFCCC that details greenhouse gas emissions (GHGs) and provides vulnerability assessments and actions to adapt to climate change.[34] Any actions on climate change should be coordinated with the national communication office of that country.

The aims of this stage are to: create an operational foundation for the subsequent preparation of the plan and its implementation; to begin the process of understanding the challenges facing an area and the differing perceptions of those challenges; and to begin building a constituency of support for the plan.

Practice shows that an efficient co-ordination structure includes three bodies – a **steering group**, a **technical group** and a **consultative group**. Addressing climate change will require:

- **Steering group** should be made of representatives of national government or a competent senior-level local administration(s) that are familiar with climate issues. The role of the steering group is to ensure the smooth running of the project; to support and facilitate implementation of decisions; to enhance synergy among competent authorities to ensure political legitimacy and provide financial accountability.
- The **technical group** requires experts with a knowledge of adaptation to climate change. This group should develop a high-quality plan using the best available technical and logistical support.
- The **consultative group** should include someone from the national communication office and a representative from those sectors where climate issues are important at Stage 1.4 (Scoping). The role of this group is to reflect the opinions and expertise of the community and to act as a consultative body at all stages of the drafting and approval of the plan.

[34] For details see: http://unfccc.int/national_reports/items/ 1408.php. Annex One countries (i.e. those that have a target reduction of GHGs under the Kyoto Protocol) also have to provide information on policies and measures that have been introduced.

1.2 Defining territorial scope

Climate change will have an impact on areas that do not necessary respect the boundaries of a coastal zone as defined in the ICZM Protocol. For example, sea-level rise and extreme events may affect areas that extend beyond the defined boundaries, yet they are part of a larger area that includes the coastal zones.

The Protocol proposes a seaward limit of the coastal zone as the external limit of the territorial sea; while the landward limit is the limit of the competent coastal units. Countries should decide on the competent coastal units when ratifying the Protocol, and the coastal adaptation plan is the time to reconfirm this decision. The "competent" coastal units should be reconciled with the ecosystem and economic, social and political criteria as appropriate.

When defining the territorial scope of the areas to be covered under the coastal adaptation plan one needs to think about the "feasibility"; in general, it makes sense to retain administrative boundaries where possible to maintain the integrity of stakeholder accountability and recognition, policy conformity and statistical information. A pragmatic compromise between ecosystem features and administrative requirements should prevail.

1.3 Defining governance context

The institutional context for climate change planning is usually already well established, although institutions may not be fully aware on their role in climate action. In addition to a national communication office, and local and regional governments that are considering actions to adapt to climate change, several departments may also be involved:

- Agriculture and forestry department(s) because of potential impacts on crop yields and forestry resources,
- Environment department(s), especially the body responsible for water management, biodiversity conservation, ecosystem health, coastal and marine protection,
- Health department(s), e.g. for the consequences of heat waves, vector and water-borne diseases and the increased risk of food contamination from higher temperatures,
- Agencies responsible for land-use planning (local and central),
- Tourism department(s), considering the potential impacts and in some cases even benefits for the tourism activities,
- Physical planning, construction, and infrastructure department(s),
- Transport departments, for the implication of climate changes on different modalities of transportation, including port activities and shipping,
- Education and research departments, considering the need to anchor the adaptation process on a reliable scientific base.

The private sector is also actively engaged in coastal areas. Individuals and companies with significant investments are sometimes aware of increased climate change risks and may be planning remedial measures. However, these measures will depend very much on what policies the government has in place, highlighting the strong connection by these two sets of actors. It is critical to be aware of private sector plans to provide it with the right framework and incentives so that it can make a cost-effective contribution to climate change adaptation.

1.4 Scoping

When preparing coastal adaptation plans, the pressures and impacts that are most relevant to a particular area need to be identified. These pressures will depend on future plans for land and marine use, which are a key determinant of the impacts that result from the climate-related factors above. The climate drivers will also depend on policies for water and land management that are in place or likely to be introduced.

Any coastal adaptation plan should note the important climatic drivers and pressures. At the national planning stage national level data will be collected and at the local planning stage further relevant and more detailed data will be assembled.

The scoping stage, including risk identification, is primarily a desk exercise in conjunction with key stakeholders and technical experts from relevant sectors. Risk is conventionally categorised according to:

- the nature of the risk and its consequences,
- the magnitude of possible adverse consequences from each risk, and
- the probability of the occurrence of each risk.

In the case of climate change, objective probabilities cannot be defined in most cases. However, broad probability categories based on modelling and expert judgement are available for some pressures and impacts. These categories may predict to what extent an event such as a temperature increase is "likely" (if the probability of it being exceeded is less than 50%) or "unlikely" (if the probability of it being exceeded is less 10%). At this stage, the exercise should determine which of the key impacts identified in the previous stage have the highest probability.

This information is likely to be available for extreme events, sea-level rise, temperature increase, and perhaps changes in precipitation levels. Together with the data on key problems, such information will help at the later stage when the analysis of options is carried out.

1.5 Engaging stakeholders

Stakeholder participation in any plan preparation is essential. Key groups must be informed of major climate changes, the likely consequences of those changes and the increased risks they represent. This can be done without providing too much technical detail. The groups that need to be involved will include local communities, government agencies, scientific institutions, NGOs, business, media and opinion makers, tourism service providers, private developers, people working in agriculture and fisheries, etc. Based on consultations with these groups, options for action can be drawn up. The role of stakeholders is discussed in greater detail in Section 3.

A simple **communication strategy** should be devised during or shortly after the establishment stage. It should outline how different participatory activities will be carried out and what other communications will be made. The coastal adaptation plan should include the preparation of a broad communication strategy and the identification of key stakeholders. The details of the communication strategy and the groups or individuals to be invited should be spelled out in the plan.

1.6 Proposing a vision

The vision is proposed at this stage to get stakeholders on board for preparation of the coastal adaptation plan. When stakeholders recognize the potential of the plan for their region, and have common understanding of challenges, the running of the project will be much smoother. This is the moment of seeding the ownership of the plan.

Some of the analytical measures identified may give rise to outsourcing studies that will provide technical material to be integrated into the main planning framework. All such studies must be seen as part of the overall input into the preparation of the plan, and there has to be enough expertise among the core team to be able to understand the results of the studies and to use them in preparing the coastal adaptation plan.

1.7 Decision on a strategic environmental assessment (SEA)

Strategic Environmental Assessment (SEA) is "a systematic process for evaluating the environmental consequences of proposed policy, plan or programme initiatives to ensure that they are fully included and appropriately addressed at the earliest stage of decision-making, on a par with economic and social considerations (UNEP/MAP/PAP, 2015)." A number of countries have a statutory requirement to carry out a strategic environmental assessment (SEA) when a major project or policy change is being considered. This tool can be useful when actions are proposed across a number of sectors, or when actions in one sector are likely to have an impact across several

sectors. It can also be useful when the time frames for actions are different, for example, some land-use measures may conflict in the short term with climate adaptation objectives in the long term.

SEA should include any policies and measures also for the climate component. It should be noted that the exercise is a complicated one because it entails examining a combination of policies across a range of sectors for their impacts on environmental resources and hence, requires considerable resources and time. Ultimately, it is a decision that the steering group must take in light of the national policy for SEAs.

Even if an SEA is not carried out, an assessment of the cross effects of the different policies is needed. Development programmes that expand land use in coastal areas have to be undertaken with future consequences and climate costs in mind. An expansion of tourism that does not account for the impacts of climate change on visitors or of changes in water availability could result in failure.

A decision on an SEA should be taken at the planning stage. Its application will be within the national plan since it is unlikely that local plans have sufficient resources to prepare an SEA.

2. Analysis and Futures

The overall aim of this stage is to find root causes of problems initially identified in the preceding Establishment stage, and to identify and understand the past, present and future trends; – making the invisible visible and engaging stakeholders in the search for outcomes.

2.1 Background and building the evidence

The two sub-stages addressed in this section are:

- building the evidence, and
- identifying the futures.

The aim of the first is to establish an operational foundation for the preparation of the 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 sub-stage is dedicated to identifying policies and priorities for action. The selection of the actual policies and options will be made when preparing the national and local plans (depending on whether the policies and options are national or local). This represents the basis for work on pilot projects and for sources of funding.

To build the evidence, one must know from where to get the relevant information. The Intergovernmental Panel on Climate Change (IPCC) is an international body created for this purpose: to provide the regular assessments of the scientific basis on climate change, its impacts and future risks, and options for adaptation and mitigation. At the Mediterranean level, the Mediterranean Experts on Climate and Environmental Change (MedECC) network is expected to provide a similar effort, detailing climate change understandings on the specific characteristics of this region.

Box 3: The Intergovernmental Panel on Climate Change (IPCC)

Created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP), the objective of the IPCC is to provide governments at all levels with scientific information that they can use to develop climate mitigation and adaptation policies. IPCC reports are also a key input into international climate change negotiations.

The IPCC is an organization of governments that are members of the United Nations or WMO. The IPCC currently has 195 members. Thousands of experts from all over the world contribute to the work of the IPCC. For the assessment reports, selected scientists volunteer their time to assess the thousands of scientific papers published each year to provide a comprehensive summary of what is known about the drivers of climate change, its impacts and future risks, and how adaptation and mitigation can reduce those risks.

An open and transparent review by experts and governments around the world is an essential part of the IPCC process, to ensure an objective and complete assessment and to reflect a diverse range of views and expertise. Through its assessments, the IPCC identifies the strength of scientific agreement in different areas and indicates where further research is needed. The IPCC does not conduct its own research.

Past trends and future climatic projections for Mediterranean and Adriatic Ionian region

The Mediterranean region has been identified as a "hotspot" of climate change, because of its high vulnerability to the current and future climate change impacts, affecting a high number of economic sectors and ecosystems.

Information on past and future climate variability in the Mediterranean region and sub-regions can be found in reports issued by EEA (covering the whole European Region) and in numerous scientific articles, whose main findings are outlined in comprehensive publications, scientific books and syntheses (e.g. Lionello *et al.*, 2006; Lionello, 2012, Navarra and Tubiana, 2013; Allenvi, 2016; MedECC, 2018). New comprehensive insight about climate change in the Mediterranean is expected through the MedECC[35] initiative, an international scientific expert network working towards a regional science-policy interface for climatic and other environmental changes across the Mediterranean (MedECC, 2018). In 2020, MedECC has published the First Mediterranean Assessment Report (MAR1) on the current state and expected risks of climate and environmental change in the Mediterranean Basin[36].

The European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC-CCA) of the EEA recently issued a report on transnational cooperation on climate change adaptation in Europe (Ramieri *et al.*, 2018). Among the others, the report provides a summary description of observed and projected climate changes and their impacts in the European transnational regions, based on a wide literature review, also including most of the papers mentioned in this chapter. The following tables summarises major evidence for the Mediterranean (Table 2) and the Adriatic-Ionian regions (Table 3); it shall be considered that some of the elements highlighted for the Mediterranean Sea, assume relevance for the Adriatic-Ionian region as well.

Table 2: Observed and projected climate change and impacts, and risks for the Mediterranean region (Adapted from Ramieri et al., 2018)

Mediterranean
Relevant observed and projected climate change and impacts
▪ Increase in air temperature (larger than global average) ▪ Decrease in precipitation ▪ Increase in duration and intensity of heat waves ▪ Increase in frequency and duration of droughts ▪ Decrease in water availability and runoff ▪ Sea level rise ▪ Increase in sea surface temperature ▪ Increase in sea water acidification ▪ Loss of biodiversity in the marine ecosystems
Relevant risks
▪ Increase of risk for wildfires and forest fires ▪ Risk of coastal flooding ▪ Increase risk of heat related morbidity and mortality ▪ Increasing risk of losses for different water users (e.g. agriculture, energy production) ▪ Increasing risk of vector borne diseases ▪ Increasing risk of pests and diseases in agriculture and forestry ▪ Risk of losses of arable soil due to salinization ▪ Risk of coastal aquifers salinization ▪ Risk of decrease of tourism ▪ Increasing in energy demand for cooling ▪ Risks from acidification to marine life ▪ Risks from invasive species

[35] http://www.medecc.org/

[36] https://www.medecc.org/first-mediterranean-assessment-report-mar1/

Table 3: Observed and projected climate change and impacts, and risks for the Adriatic-Ionian region (Adapted from Ramieri et al., 2018)

Adriatic-Ionian Region
Relevant observed and projected climate change and impacts
▪ Increase in air temperatures ▪ Decrease in summer precipitation in the northern Adriatic ▪ Increase in frequency and intensity of heat waves ▪ Increase in frequency and intensity of droughts ▪ Biodiversity regime shifts
Relevant risks
▪ Decrease in summer tourism ▪ Risk of coastal flooding ▪ Losses for tourism due to beach erosion ▪ Negative impacts from changes in biodiversity, and invasive species on fisheries and infrastructure

A strong increase in temperature is predicted for the Mediterranean, especially in summer and even larger than at global scale. Several studies agree on a general increase in temperature starting from the twentieth century. Surface air temperature trend over the 1960 – 2005 period (Mariotti *et al.*, 2015) is estimated in the range between 0.19 °C e 0.25 °C per decade. In summer, warming rate is even higher (0.3°C per decade). After the 1980s, data suggest that warming in the Mediterranean region has been larger than at global scale (Lionello and Scarascia, 2018).

Projections for the future confirm this evidence, indicating that the Mediterranean region is likely to warm at a rate about 20% larger than the global annual mean surface temperature, with values particularly large in summer and in the continental areas north of the basin (Lionello and Scarascia, 2018).

The increase of annual mean temperature in the Adriatic-Ionian region has been less intense compared to other areas of the Mediterranean (EEA, 2017). However, projections for the 21st century for the eastern Adriatic (Croatian coast, according to IPCC SRES A1B scenario) suggest an overall increase of temperatures, especially in summer and early autumn, gradually rising from 2 °C in the near future to 5.5 °C towards the end of the century (Branković *et al.*, 2013). Similarly, for the western Adriatic (Italy), Bucchignani *et al.* (2016) reports a projected warming of about 3 °C (according to the IPCC RCP 4.5 scenario) and higher than 4 °C for RCP 8.5 scenario, with wide spatial and seasonal differences.

A general decrease in precipitation is observed and expected for the Mediterranean region, leading to an overall warmer and drier climate, despite a high spatial heterogeneity. Observations over the 1960–2005 period confirm a decreasing trend of the average daily precipitation of about $-0.6 \cdot 10^{-2}$ mm/day/decade (Ducrocq *et al.*, 2016; Mariotti *et al.*, 2015). The reduction of precipitation is considered the most critical issue for the Mediterranean environment (Lionello and Scarascia, 2018), in contrast with the general increase of the hydrological cycle of other areas of same latitudes. In the northern parts of the Mediterranean precipitation will reduce in summer, while in the central and southern Mediterranean, the reduction will feature all seasons.

Summer precipitation is projected to decrease in the northern Adriatic region, where an increase of winter precipitation is generally expected (Zampieri *et al.*, 2012; Montesarchio *et al.*, 2013; Bucchignani *et al.* 2016).

The general decreasing trend of precipitation in the Mediterranean region will affect the reduction on river runoff (Vincente-Serrano *et al.*, 2016) and soil moisture (Kurnik *et al.*, 2015) with clear impacts on agriculture.

Several evidences suggest a change in extreme events in the Mediterranean region, in addition to changes in average climatic variables, with a probable increase of duration and frequency of heat waves (Gualdi *et al.*, 2013) and droughts (Stagge *et al.*, 2015).

Box 4: The IPCC Representative Concentration Pathway Scenarios

Key elements for future projections of climate change are the emission rates of greenhouse gases that can change according to different models of socio-economic growth, and also to the implementation of alternative possible mitigation policies.

Scenarios used for projections in the Fifth Assessment Report (AR5) of IPCC (2013) are four "Representative Concentration Pathways" (RCP). They are referred as:

- "pathways" in order to emphasize that are not definitive scenarios, but rather internally consistent sets of time-dependent forcing projections that could potentially be realized with more than one underlying socioeconomic scenario.
- "representative" in that they are one of several different scenarios, sampling the full range of published scenarios.
- "concentration", because the primary products of the RCPs are concentrations and corresponding emissions

The four scenarios are identified by the 21st century peak or stabilization value of the Radiative Forcing (RF) derived by the reference model (in Wm^{-2}):

- RCP 2.6, the lowest scenario, which peaks at 3 Wm^{-2} and then declines to approximately 2.6 Wm^{-2} by 2100;
- RCP 4.5, the medium-low scenario, with a stabilization at 4.5 Wm^{-2} by 2100;
- RCP 6, the medium-high scenario with a stabilization at 4.6 Wm^{-2} by 2100;
- RCP 8.5, the highest scenario, which implies a RF of 8.5 Wm^{-2} by 2100, with rising RF beyond that date.

RCP 4.5 is close to the previously used IPCC SRES B1 scenario, RCP6 is close to SRES A1B (more after 2100 than during the 21st century) and RCP8.5 is somewhat higher than A2 in 2100 and close to the SRES A1FI scenario. RCP2.6 is lower than any of the SRES scenarios.

Figure 2 presents relative to preindustrial (about 1765) between 1950 and 2100. Previous IPCC assessments (SAR IS92a, TAR/ AR4 SRES A1B, A2 and B1) are compared with representative concentration pathway (RCP) scenarios.

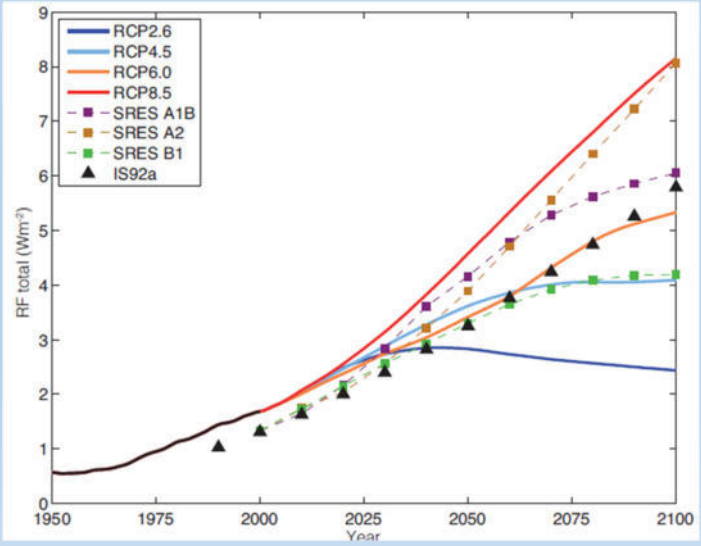


Figure 2: Historical and projected total anthropogenic RF (Wm^{-2})

Sea level, strictly related to global warming, is increasing in the Mediterranean. Data from tide gauges in the Northern Mediterranean basin (Galassi and Spada, 2014; Zerbini *et al.*, 2017) show a rise of about 1.2–1.3 mm/year during the twentieth century, despite a spatial and temporal variability. Regional sea-level variability of Mediterranean Sea is induced by direct atmospheric forcing (winds and pressure) and steric changes (related to temperature and salinity), causing regional anomalies with respect to the global trend.

Making projections on sea level rise for the Mediterranean is really challenging, especially for the uncertainties affecting the water exchange with the Atlantic Ocean, through the Strait of Gibraltar. Taking into consideration all potential contributions and uncertainties, Somot *et al.* (2016) suggest a wide range for sea level rise by 2100, between 40 and 110 cm, with significant local variations that differ from the average value over the entire basin. Relative sea level rise estimates, that include local vertical land movements, project for the Northern Adriatic Sea an increase up to 58 cm, considering the worst IPCC scenario, with about 5000 Km^2 of areas at risk of flooding along the Western North Adriatic coast (Antonioli *et al.*, 2017; Marisco, *et al.*, 2017).

Climate change impacts on key sectors in coastal zones in Croatia and Italy

Coastal zones in Italy and Croatia, just as in rest of the Mediterranean, are the most appealing national assets. However, coastal zones are usually exposed to enormous pressures from land-based and marine pollution, urban development, fishing, aquaculture, tourism, extraction of materials, and marine biological invasions. With global warming and sea rise, these pressures will increase.

In particular, many coastal systems will experience increased inundations and storm flooding, accelerated coastal erosion, seawater contamination of fresh groundwater, encroachment of tidal waters into estuaries and river systems, and elevated sea surface and ground temperatures. Other impacts may include changes in chemical (ocean acidification) and physical characteristics (thermal stratification) of marine systems, increased harmful algal blooms, the spread of invasive species, habitat loss (especially coastal wetlands), species migrations, and changes in population dynamics among marine and coastal species.

These bio-geophysical effects will, in turn, have a direct and indirect socio-economic impact on tourism, human settlements, agriculture, freshwater supply and quality, fisheries, financial services, and human health in coastal zones (Nicholls *et al.*, 2011).

The main impacts of climate variability and change on coastal zones in Croatia and Italy, and their interrelation, are shown in Figure 3.

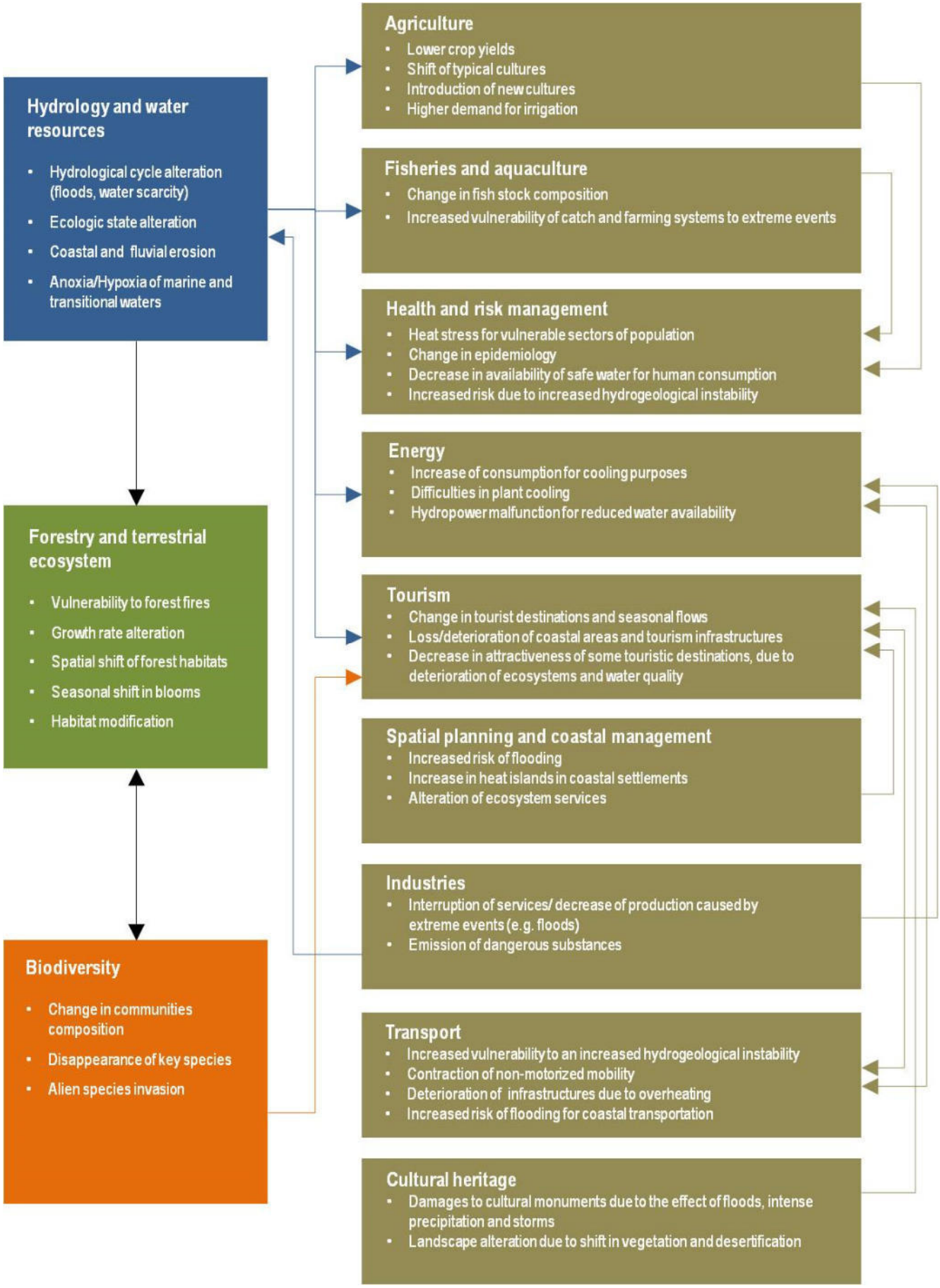


Figure 3: Impacts of climate change on key sectors in Croatia and Italy

2.2 Building the future

Policies and priorities for actions that will be taken based on the above information must take into account their effects on all three pillars of sustainable development: economic, environmental and social. The range of relevant policies and options will be identified, along with possible pilot actions and sources of funding. The selection of the actual policies and options will be made when preparing the plans.

The climate change factors to be discussed are of varying importance, depending on which sector or area of policy is under consideration. In the following sections policy areas where climatic factors play an important role are discussed including the relevant connections between adaption and disaster risk reduction.

Disaster Risk Reduction and Climate Change Adaptation

Climate change adaptation can be defined as a continuous adjustment (autonomous or planned) of natural or anthropic systems in response to the expected climate changes and their impacts, with the aim of reducing the vulnerability of these systems, increasing their resilience and exploiting possible opportunities. Therefore, it is a gradual and far looking process which deals with both extreme and slow-onset events. Disaster risk reduction (DRR) focuses on the present or next future by addressing existing and urgent risks caused by all typology of hazards (not only climate and climate change-related ones).

Notwithstanding these differences, climate change adaptation and DRR are strictly inter-connected, facing a number of common issues (e.g. the incomplete and uncertain knowledge basis), sharing similar approaches (e.g. ecosystem-based solutions) and pursuing common objectives (reduction of exposure and vulnerability to risks and improvement of resilience).

Moreover, a wide number of climate-related risks can be triggered by climate extremes and aggravated by climate change directly (e.g. heavy precipitation, windstorms, storm surges, heatwaves, droughts, etc.) or indirectly (e.g. river and sea floods, forest fires, coastal and soil erosion, landslides, etc.). Disaster risk also depends on the exposure (e.g. land use and territorial planning) and vulnerability of human society and natural ecosystems (cultural, social, and environmental). Both Disaster Risk Management and climate change adaptation can reduce exposure and vulnerability to weather and climate events and thus reduce disaster risk, as well as increase resilience to the risks that cannot be eliminated (Figure 3). Climate change adaptation can benefit from DRR experience in managing extreme events such as flooding, landslides, and storms (IIED, 2009).

Coherence between policies, knowledge and practices concerning DRR and climate change adaptation is then highly recommended. Positive impulses come from existing global policies (the 2030 Agenda for Sustainable Development[37], the Sendai Framework for Disaster Risk Reduction 2015–2030[38]) and European Policies (e.g. the EU Strategy on Adaptation to Climate Change[39], The EU's Civil Protection Mechanism[40]), providing an overarching framework linking the two processes (EEA, 2017).

[37] https://www.un.org/sustainabledevelopment/

[38] https://www.unisdr.org/we/inform/publications/43291

[39] COM(2013) 216 final. An EU Strategy on adaptation to climate change. 16.04.2013.

[40] https://ec.europa.eu/echo/what/civil-protection/mechanism_en

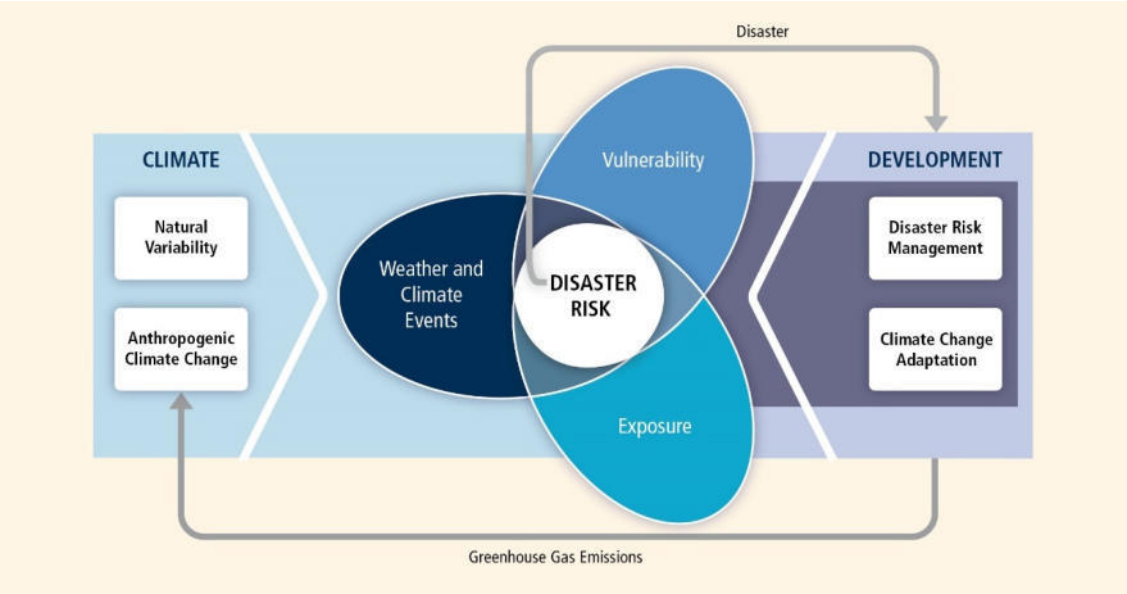


Figure 4: Conceptual model illustrating interconnection between Climate Change Adaptation and Disaster Risk Reduction (Source: IPCC, 2012)

Agriculture

The impacts on agriculture are of wider interest and relevance than just to a coastal community. Adaptation measures can include research and development on crop varieties better suited to the new climate, improved efficient irrigation (where appropriate), early warning systems and other support to farmers to assist them to adapt to climatic changes. In coastal zones where water scarcity is already at a premium, appropriate adaptation plans may differ from other areas. Therefore, it is probably best that those participating actively in national agricultural adaptation programmes as well participate in the planning for water allocation and management.

Infrastructure

Sea-level rise and changes in extreme events will have a direct bearing on coastal infrastructure. Fortunately, this is an area that is the most developed in terms of tools to assess the appropriate responses. For example, the DIVA model has been used to estimate the required investment in coastal protection for different parts of the European coastline (Hinkel *et al.*, 2010), as well as in Croatia in 2014 (see Box 5). The model looks at the typical impacts of climate change on coastal areas:

- coastal erosion,
- increased flood risk and inundation,
- coastal wetland loss and change, and
- salinization.

It estimates the best responses based on their costs and benefits. The responses considered by DIVA include flood defences and beach nourishment but not all the softer options, such as insurance. The model has been applied to most of the European coastline, including some areas of the Mediterranean.

Health

As with agriculture, this is an issue wider than just coastal zones, although the latter could be especially affected if there is an increase in vector borne diseases. The key impact on human health would be increased mortality by heat waves. Also, impacts on human health through contaminated food and water will require stricter controls on providers. The planners need to review its regulations and look at ways to improve health safety where required.

Water

Adaptation to changes in water supply will take the form of reducing demand (including measures that promote more efficient use, increases in water charges) and increases in storage and available supply. The latter could involve the building of reservoirs, runoff management capacities, plans for water allocation in periods of drought and even the transfer of water from surplus to deficit areas. There is also the option of building desalinisation facilities to meet water deficits, which is fully sustainable only if integrated with renewable energy generation. In coastal areas all of these could be relevant and need to be considered, including the increasing demand for water. Tourism, for example, in particular creates additional demands for water and energy. It is important to anticipate that energy produced from hydropower in the future may decrease in the summer months, exactly when tourist zones need the most energy.

Tourism

For most coastal zones tourism is a key sector and the impacts of climate change on visitor numbers is critical information for planning and management in these areas. A number of models have been used to try and predict changes in tourism flows by country and season due to climate change. The results varied, with some models showing significant decreases in the Mediterranean region while others indicate the opposite. What is clear, however, is that there will be more competition from Northern Europe, where summers will be warmer and it will be more attractive for visitors to come to the Mediterranean in the shoulder seasons of April and October.

For example, Fischer (2007) provides estimates of changes in numbers of tourists under different scenarios. For the Mediterranean the study states that the region will be too hot during summer, but climatic conditions will improve during spring and autumn, leading to extended touristic seasons. Still according to the study, considering the rising summer temperatures in northern Europe, it is likely that the Mediterranean and its related tourism industry will encounter a decrease in international tourist arrivals in summer and an increase during the spring and autumn.

In terms of planning, it is important to assess the volumes of visitors that can be expected and the typology of needed facilities. This information will be a direct input into strategies for the kind of developments that are appropriate for each coastal zone. Finally, this information has a direct impact to one of the major issues of the coastal zone – ever increasing built-up density. Redistribution of visitors out of the summer period may mean that we do not need to construct more and that we may finally limit constant growth of the coastal built-up density.

Ecosystem protection

The impacts on ecosystems are very location specific. Studies under the CIRCE Project[41] identified low flows in rivers as an important impact, but consequences on marine systems and fisheries can also be expected. This is an area where planners and managers should undertake a local assessment, drawing, of course, on the existing literature. Information collected at the analysis stage will influence the measures that need to be introduced. Some downscaling of impact assessment using models will probably be required. For rivers, low flow alleviation may be required to avoid loss of recreation services and risks to species. For marine areas, protection of new areas and better connection of existing protected areas may be advisable and certain measures are needed to improve sustainable management of fisheries and aquaculture.

[41] https://www.cmcc.it/projects/circe-climate-change-and-impact-research-the-mediterranean-environment

Box 5: Application of the Diva tool in Croatia

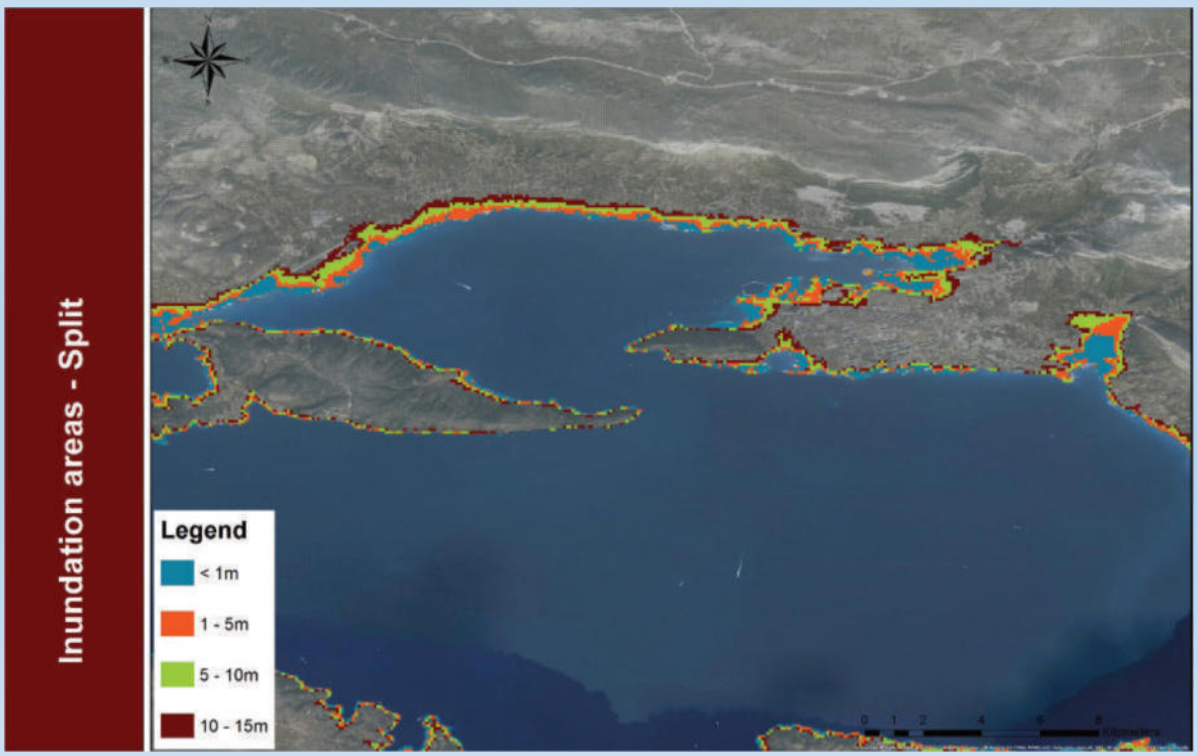
The application of Dynamic Integrated Vulnerability Assessment (DIVA) method in Croatia (in 2014) focused on: increased coastal flood risk in terms of the expected annual damages of extreme sea level events (storm surges), in terms of monetary damages to assets and number of people affected, and dry land loss due to increased coastal erosion from sea-level rise and resulting damages.

The assessment showed that the impacts of sea-level rise in Croatia will be substantial in the 21st century if no adaptation measures are taken. The area of Croatian coastal zone exposed to the 1-in-100 year coastal extreme water level will increase from the current 240 km^2 to 320-360 km^2 in the late 21st century. The expected number of people flooded annually will increase from 17,000 in 2010 to 43,000–128,000 in 2100, and the expected annual damages from USD 40 million in 2010 to 0.9 to 8.9 billion per year in 2100.

The analysis also showed that impacts would be significantly reduced by applying the appropriate adaptation measures. Adaptation investment depends on the population density thresholds above which dike construction should take place. In case that segments with more than 30 inhabitants/km^2 are protected, this would result in protecting 84% of Croatia's coastline, costing USD 11.2 billion. In case that segments with more than 200 inhabitants/ km^2 are protected the share of coastline to protect would be 49.6%, costing USD 6.5 billion. While these costs are substantial, they are at least one order of magnitude lower than the avoided damage costs.

By applying the DIVA method to the Croatian coast, the discrepancy between population projections and the intense coastal urbanization came into focus. Although the projections for Croatia indicate a population decrease, spatial plans allow for a 10-fold increase in the urbanized coast compared to before the 1960s. The highly seasonal character of tourism focused on "sun, sea and beach" encourages the construction of tourism facilities in the zone with the greatest danger from sea-level rise and related events.

The outputs of the DIVA assessment summarize the potential costs of increasing the exposure of this high-density construction to sea-level rise and extreme water levels. An interesting finding is that in Croatia the areas with high asset exposure to coastal flooding are not necessarily ones with high population exposure, and vice versa. For example, Vodice municipality has the fourth biggest value of assets in the floodplain, but at the same time it is not even among top ten areas regarding population in the floodplain.



3 Setting the Vision

The overall objective of this stage is to engage stakeholders in the joint vision for the plan area, and to set the course for the eventual shape of the plan and its implementation. From a selected set of alternatives, the team, in agreement with stakeholders and based on the necessary trade-offs between different interest groups and uses, will propose the optimal long-term vision.

The vision should include, or be complemented by, a set of goals so we know what we want to accomplish, who are committed to this vision and eventually how they will contribute. The "when" and the "what" will pave the way towards understanding how much it will cost and what the consequences and benefits will be.

3.1 Building consensus

This step aims at reaching agreement among stakeholders and the wider community on the key problems, issues and priorities for the plan area.

Inclusive governance

The point of departure for this stage is the scoping report, which was prepared at the establishment stage (Stage 1; see Chapter 1.4). This report is discussed with stakeholders and amended in light of their reactions. Stakeholder consultations are used to determine priorities.

Because of climate change's long-term and uncertain nature, as well as its integrated nature, responding to it may be particularly complex and contentious compared to other, more tangible environmental problems. For this reason, coastal adaptation must be carried out as an inclusive, strategic and adaptive process for the assessment of climate change impacts, planning, implementation, and evaluation. 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. They should be kept involved not only during the project, but also afterwards through the appropriate long-term organizational and institutional arrangements to ensure more effective implementation and sustainability.

The benefits of widening participation to all interests involved in making a decision include improving local "ownership" of strategies and ensuring decisions meet the needs of citizens (Fletcher, 2003).

Article 14 of the ICZM Protocol devotes an entire section to the participatory process, envisioning the involvement of all stakeholders in the formulation and implementation of coastal and marine strategies, plans, programmes or projects to guarantee efficient governance of the ICZM process (Box 6).

Only when all groups of actors are actively involved in a participatory manner, the process can efficiently address the challenges climate variability and climate change pose to coastal management and led to the development of successful community-based solutions. Concepts of good governance are important aspects in this regard through the provision of legal security, transparency, accountability and the freedom to express one's views (McLennan *et al.*, 2014).

Each step of the planning process provides opportunities for stakeholder participation (Figure 4). There are many methods that can be used to facilitate this critical part of the planning effort, which actually depend on the typology of engaged stakeholders and on the stage of the process at which they are involved. They include, but are not limited to, charrettes, focus groups, open houses, workshops, world café and public meetings. There is no "one size fits all" solution for stakeholder participation. One needs to review and choose those methods that are most likely to result in effective and efficient stakeholder participation in certain area (NOAA, 2007).

Box 6: "Participation" in the ICZM Protocol

Article 14 of the ICZM Protocol states that:

"the Parties shall take the necessary measures to ensure the appropriate involvement in the phases of the formulation and implementation of coastal and marine strategies, plans and programmes or projects, as well as the issuing of the various authorizations, of the various stakeholders, including:

- *territorial communities and public entities concerned,*
- *economic operators,*
- *non-governmental organizations,*
- *social actors,*
- *the concerned public."*

Establishment	Ensure full engagement of all stakeholders in the plan process and its implementation by means of a stakeholder analysis.
Analysis and futures	Integrate in the analysis process and scenarios building all the stakeholders, in order to stimulate discussions about common future, expand the range of adaptation options and expose existing conflicts and uncertainties.
Setting the vision	Stakeholders should actively contribute to identification of adaptation options, by sharing different perceptions and representations of coastal measures.
Designing the future	Involve stakeholders to review, select and build consensus on the most appropriate adaptation strategy that would be adopted.
Realizing the vision	In this phase, stakeholders might consider the monitoring and evaluating the results of the strategy adopted.

Figure 5: Participation in the five phases of the ICZM process (adapted from the PEGASO project (Soriani et al., 2014)

Resilience-building approaches and initiatives for coastal communities

Healthy coastal ecosystems will play a major part in helping coastal communities to adapt to climate change.

The resilience of a coastal community can be built by the adoption of ecosystems-based adaptation (EbA) to climate change, meaning restoration, enhancement, conservation and wise use of natural resources with the active engagement of local communities to enable the ecosystems to function properly and to deliver services for the benefits of nature and local livelihoods, which in turn build societal resilience to the impacts of climate change.

The concept of "coastal resilience" is a new way of thinking about how to protect coastal communities better from climate-related hazards. Planning for resilience can proactively reduce hazard risk and vulnerability. Indeed, resilient communities

understand the hazards they face, take specific and coordinated actions to reduce their vulnerability, and develop responses and recovery plans to facilitate a quick response and effective long-term recovery should a disaster occur. Coastal resilience is now being actively promoted as a management strategy by several organizations and agencies (IOC/UNESCO, 2012). Thus, taking into account the specificity and diversity of the socio-economic conditions in the Mediterranean basin, together with the fact that this region is considered to be a climate change hotspot, building a resilience strategy is a priority, an "no regret" action.

Box 7: What is resilience?

Resilience – from the Latin *resilio*, meaning "to spring back".

IPCC: Resilience "*is the ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration or improvement of its essential basic structures and functions*" (Lavell *et al.*, 2012).

UNISDR (2009)[42]: Resilience is "*the ability of a system, community or society exposed to hazards to resist, absorb accommodate to and recover from the effects of a hazard in a timely and efficient manner including through the preservation and restoration of its essential basic structures and functions*".

NOAA[43]: **Coastal resilience** means building the ability of a community to "bounce back" after hazardous events such as hurricanes, coastal storms, and flooding – rather than simply reacting to impacts.

Box 8: The "Climagine" approach

Within the framework of the MedPartnership sister project "Integration of Climate Variability and Change into National ICZM Strategies" (ClimVar & ICZM), Plan Bleu and PAP/RAC developed and tested a participatory method that addresses the specific challenges of climate variability and change in coastal zones in two selected demonstration cases: Tunisia and Croatia. This method, called ***"Climagine,"*** is an adaptation of *"Imagine"* developed by Plan Bleu in collaboration with the Bayswater Institute (UK) in the year 2000 to address sustainable coastal zone management needs in the Mediterranean.

"Climagine" is the *"Imagine"* method with a climate dimension. It is a framework for local governance to prepare a coastal plan in an integrative way and in a participative manner, taking into account physical and socio-economic impacts on coastal environment.

In Šibenik-Knin County of Croatia, *"Climagine"* was presented to the county authorities as a parallel activity that would incorporate local knowledge into the coastal plan and help local players take ownership of the process, thereby increasing the probability of it being implemented effectively. In the course of four workshops, 50-odd local actors discussed critical issues of the County coastal development, and jointly sought solutions to maintain sustainability and resilience of the coastal area.

[42] http://www.unisdr.org/files/7817_UNISDRTerminology English.pdf
[43] http://oceanservice.noaa.gov/facts/resilience.html

3.2 Setting the direction

"Setting the direction" is observing the priorities and the consistency of the objectives of the plan. These objectives can be complex, consisting of high-level objectives (or goals) and clusters of sub-objectives).

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).

Climate change priorities will have to be drawn from a range of possible actions. As an initial screening, the measures can be classified as:

- **Low regret or No-regrets measures**: These measures that can be introduced now to adapt to climate change, incurring little or no cost and generating a range of benefits both in the present and the future. Examples include: improved efficiency in water use, the development of early warning systems that inform affected parties of extreme weather events, improved monitoring of climate data to better predict impacts from higher temperatures and changes in rainfall patterns. Also included in this category are measures to address the "adaptation deficit." An adaptation deficit arises when the current infrastructure or more in general a coastal area is inadequate to cope with the present climatic variations (e.g., current flood defences are inadequate to cope with present flooding). Actions to correct this situation can possibly be justified even without reference to future climate change, although it may still not be the top priority.
- **Action vs. Postponement**: The literature on adaptation notes the benefits in some cases of postponing decisions, for example on the height of a sea defence, until more information is available on the likely risks. This can be done through an analytical method known as Real Options Analysis[44].
- **Societal, Green and Grey measures:**

  Societal (also so-called "soft") **measures** include policy, legal, social, management and financial measures that can modify human behaviour and styles of governance, contributing to improve adaptation capacity and to increase awareness on climate change issues. These measures may involve policy changes and may benefit from administrative coordination among different actors. Examples include: mainstreaming of adaptation into land-use planning; improving integrated governance of climate change adaptation; awareness raising and public information campaigns; economic diversification and insurance; early warning systems; etc.

  Green measures refer to a wide range of solutions which are based on the ecosystem-based approach (also known as nature-based approach). These types of measures utilise natural or ecosystem-like processes to improve resilience and adaptation capacity. Examples of green measures include ecological restoration of floodplain forests, reinforcing natural defences such as dunes and cliffs as well as maintaining and restoring healthy coastal wetlands.

  Grey measures refer to technological and engineering solutions to improve adaptation of territory, infrastructures and people. Examples of this typology of option include adaptation or improvement of seawalls, or strengthening of river flood defences.
- **Long term vs. Short term**: Many climate impacts are relatively long term, involving actions now to protect coastal areas and their inhabitants ten or more years in the future. However, these impacts can be exacerbated by short- to medium-term measures introduced for other reasons (e.g., economic expansion and growth). For example, allowing settlement in an area that may be more prone to flooding may yield benefits now but will impose heavy costs later. Different options should be laid out

[44] For an example of Real Options Analysis see the assessment for the Thames defences, summarised in Ranger *et al.* (2010).

for each of the areas where some action is required and the pros and cons of each option discussed with stakeholders. The aim at this stage is not to make a final selection but to indicate broad priorities from which sets of options can be drawn and evaluated in Stage 4 (Designing the Future).

The coastal adaptation plan should describe how key problems will be analysed and how priorities will be set. For climate change it should note some of the choices that are open to the policy-makers (as outlined above). During the stage of preparing the national and local plans, the options will be further elaborated and the priorities will be determined.

3.3 Measuring success

This phase is aimed at selecting the necessary set of indicators to measure the success of both the planning process and its outcomes.

One of the suggested options is to use:

1. **Sustainability Indicators** that show how the plan is being realised,
2. **Impact Indicators** that measure how well the plan outputs are being achieved, and
3. **Performance Indicators** that measure how well the projected activities are being implemented.

An example of indicator matrix is provided in Table 4, which establishes a link between the broad objectives and the indicators that show the progress in achieving these objectives.

From a climate change perspective, the relevant broad objectives are sustainable development of the region and the protection of human life and natural and physical capital in the face of climate change. Each of these is likely to be affected by climate change. The problem with developing indicators in this context is that the threat from climate change is in the future and an assessment must be made of its magnitude, given plans for development, etc. Thus, estimating the relevant climate indicators will require considerable analytical work. This can be done, but it will require regular monitoring over the life of coastal adaptation plan. However, this effort is worthwhile since it keeps this dimension of the problem in the public's mind.

Table 4 provides a list of possible climate indicators. Each indicator will need detailed definition and refinement before it can be estimated and used.

The structure of the indicators is laid out in the plan, with the criteria they should fulfil. The selection of the specific indicators is made during the preparation of the plan. Ideally, the indicators used for evaluation of the plan's implementation should be the same as ones used in the preparatory phase, to allow some level of comparability. However, additional indicators could be added or some omitted, during the evaluation.

Table 4: Example of possible climate-related indicators that complement others for ICZM

		Climate Related Indicators for Selected Years					
Broad Indicator	**Sub Objective**	Pop. at Flood Risk	Pop. at Heat Risk	Property at Risk	Water Balance	Ecosystem Stress	Tourist Visitors
A. Healthy & Productive Economy	Maximising Economic Development	X		X	X	X	X
	Increasing Employment						X
	Foster Diversification						X
B. Healthy & Productive Environment	Minimize Habitat Destruction					X	X
	Reduce volume of all pollutants					X	
C. Public Health & Safety	Protect human life and property	X	X	X			
D. Social Cohesion	Maintain a sense of equity and social justice	X		X			

4 Designing the Future

The ultimate aim of this stage is to lay the foundations for a self-sustaining process of sustainable coastal development. It will be based on a combination of instruments including concrete actions materialised through an investment portfolio, awareness-raising, institutional adjustments, and policy changes – ultimately transforming the governance culture and the community's understanding and care for the coastal zone.

It is at the end of this stage that the Process shifts from analysing, consulting, planning, etc. to catalysing change, i.e. making things happen.

4.1 Formulating coastal adaptation plans

At this stage, coastal adaptation plans will include specific climate-related elements, containing sector-specific measures (i.e. measures designed for specific sectors like agriculture, tourism, health, water management and ecosystems conservation, primarily in conjunction with national policies in these areas) and others which are relevant for the coast as a whole (e.g. sea defences, beach nourishment, dune reconstruction or changes in land-use regulations, etc.).

4.2 Establishing management structure

This stage consists of setting up inter-sectoral management, long-term facilitation and consultation structures, and of programming the post-plan period, which ultimately will have an impact on coastal governance performance. The solutions developed in the Stage 1.3 (Defining the governance context through the plan formulation) should now be reconsidered with a view toward long-term, permanent solutions for the integration of sectors.

4.3 Embedding

At this stage, the indicators identified in Section 3.3 must to be estimated and provided. As the plan is implemented, changes in the indicators should also be estimated. This does not need to be done too frequently since the indicators will not change that frequently. For climate indicators, calculations at five-year intervals should be sufficient.

Lindos, Rhode (Source: Marko Prem, CRA/PPA, October 2011)

5 Realizing the Vision

This is the critical stage in the Process where policy design shifts to the facilitation of change. Coastal adaptation plans will deploy a combination of policy instruments, management processes and actions. The strength of ICZM and coastal adaptation is its flexibility, adaptability to local circumstances, and operability across a range of sectors and issues, and with a representative governance structure.

The objective of this crucial and long-lasting stage, is to ensure continuity and sustainability of the implementation of the plan, so that the Vision can be achieved.

5.1 Implementation

Instruments for Implementation

A central pillar of instruments to implement the coastal adaptation plan is land-use regulation and the limitation on the use of certain areas. Also important is the adoption of standards for construction, energy production and delivery, 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 from an adaptation perspective. Such instruments serve several purposes. First, they are more flexible than direct physical control over the individual whose actions are being influenced on. Second, if the instrument is in the form of a charge, it allows the authorities to raise much needed financial resources that can provide essential public goods. Third, as long as a charge is in place, it provides a continued incentive for greater efficiency, which is not the case with the use of physical controls.

Areas in which fiscal instruments can be used specifically to address some of the climate change impacts are:

- Transferable development rights, where an individual whose rights have been taken away in one location can have them reallocated in another location. Such rights make the introduction of new regulations easier and allow a market for these rights to develop (Markandya *et al.*, 2008).
- The use of charges that better reflect the cost of services, particularly related to water.
- The development of insurance markets to provide coverage against the risks of flooding, etc. To the extent that they bear at least part of the costs, this encourages the private sector and individuals to modify their behaviour and not take excessive risks, as they tend to do when the cost of all damages are covered by public funds.
- Charges to tourists to cover their additional burden on public services as a source of financing environmental protection.
- The use of direct controls under which banks and other financial institutions will not finance projects located in vulnerable coastal zones.

The range of instruments should be identified in the coastal adaptation plan, along with some priorities indicating which instruments are preferred from national and local viewpoint. The actual selection, however, will be made at the planning stage, national or sub-national.

Societal Measures

Societal measures (also known as so-called "soft" measures) include policy, legal, social, management and financial measures that can modify human behaviour and styles of governance, contributing to improve adaptation capacity and to increase awareness on climate change issues. These measures may involve policy changes and may benefit from administrative coordination among different actors. Examples include: early warning systems, land-use planning, awareness raising and public information campaigns, economic diversification and insurance.

Early warning systems

Providing coastal communities with early warning systems is a key part of developing the preparedness of those communities for coping with the rapid onset of potentially catastrophic hazards.[45] In addition, early warning is highlighted as a major component of disaster risk reduction in the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters.[46] Developing and implementing an effective early warning system requires the contribution and coordination of a wide range of individuals and institutions involved in coastal management and in adaptation strategies.

Policy and land-use regulations

It is widely recognised that land-use planning is an effective way to reduce risks associated with natural hazards. Coastal adaptation will probably require new plans, laws and regulations, and modifications of the existing ones. These measures can be incorporated into the adaptation planning process or that of an existing plan (e.g., Master Plan, hazard reduction plans, ICZM, IWRM, etc.).

Planning tools include coastal hazard mapping, risk assessment and management, cost-benefit analysis, emergency planning and preparedness. The mapping of coastal areas at risk of flooding or susceptible to erosion is an essential tool for land-use planning with respect to sea level rise and storm surges, and can be essential to help determine the most appropriate response to coastal hazards.

Development planning for undeveloped coasts offers some of the most concrete entry points for integrating climate change adaptation. The incorporation of adaptation issues in these processes can lead to the identification of new development priorities, revised strategies, supporting by-laws, law enforcement mechanisms, and monitoring and evaluation frameworks. Challenges include the time and resources required for the process and for public consultation and education.[48]

Regulatory tools will ensure that land use is regulated through the establishment of appropriate zoning within areas that are subject to, or potentially subject to, coastal hazards from sea-level rise and extreme weather events. Zoning regulations can include a wide range of considerations, such as different land uses, land-use densities, the siting of buildings, setbacks, etc.

Setback zones create a buffer between development and the sea, and provide some protection against the destructive effects of erosion or land loss resulting from accelerated sea-level rise or increased storm activity(see Box 9).

Green Measures

Green measures refer to a wide range of solutions which are based on the ecosystem-based approach (also known as nature-based approach). Ecosystem-based adaptation (EbA) is defined as "the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change" (CBD, 2009). These types of measures utilise natural or ecosystem-like processes to improve resilience and adaptation capacity. The ecosystem-based approach is encouraged by the European Strategy on Climate Change Adaptation[49] (specifically its Action 7), and by the EU Green Infrastructure Strategy[50], that consider it "among the most widely applicable, economically viable and effective tools to combat the impacts of climate change".

[45] Hazard Awareness and Risk Mitigation in Integrated Coastal Management (ICAM). Intergovernmental Oceanographic Commission. IOC Manual and Guides No. 50, ICAM Dossier No. 5, Paris, UNESCO. 2009 (English).
[46] http://www.unisdr.org/2005/wcdr/intergover/official-doc/L-docs/Hyogo-framework-for-action-english.pdf
[47] http://www.jcomm.info/index.php?option=com_content&view= article&id=168
[48] For more information see Sea-Level Rise Adaptation Primer: A Toolkit to Build Adaptive Capacity on Canada's South Coasts (2013) http://www.env.gov.bc.ca/cas/adaptation/pdf/SLR-Primer.pdf
[49] COM(2013) 216 final. An EU Strategy on adaptation to climate change. 16.04.2013.
[50] COM(2013) 249 final. Green Infrastructure (GI) — Enhancing Europe's Natural Capital. 6.05.2013

Box 9: Setbacks in the ICZM Protocol (Article 8-2)

"Under the ICZM Protocol the Parties:

(a) shall establish in coastal zones, as from the highest winter waterline, a zone where construction is not allowed. Taking into account, inter alia, the areas directly and negatively affected by climate change and natural risks, this zone may not be less than 100 metres in width, subject to the provisions of subparagraph (b) below. Stricter national measures determining this width shall continue to apply.

(b) may adapt, in a manner consistent with the objectives and principles of this Protocol, the provisions mentioned above:

1) for projects of public interest;

2) in areas having particular geographical or other local constraints, especially related to population density or social needs, where individual housing, urbanisation or development are provided for by national legal instruments,

(c) *shall notify the organization of their national legal instruments providing for the above adaptations."*

Examples of green measures include ecological restoration of floodplain forests, reinforcing natural defences such as dunes and cliffs as well as maintaining and restoring healthy coastal wetlands

Grey Measures

Grey measures refer to technological and engineering solutions to improve adaptation of territory, infrastructures and people. Examples of this typology of option include adaptation or improvement of seawalls or strengthening of river flood defences.

Networking initiatives to support adaptation

Coastal communities are particularly prone to climate change, sharing similar challenges such as flooding associated with storm surge and sea level rise, coastal erosion, and seawater intrusion in coastal aquifers. Essential services and related infrastructures, such as those in the energy, transport, tourism and health sectors, can experience severe damages from climate change in low-lying coastal cities.

Networking of coastal cities and coastal communities that faces similar challenges supports the adaptation process favouring replication and improvement of good practices. Common platforms offer space for sharing knowledge and approaches supporting the policy and decision-making process and therefore looking for common solutions. Communities' priorities, needs and capacities become more visible and favour the success of participatory approaches and methods.

Examples of successful initiatives include the following networks of cities and coastal communities:

- The *Covenant of Mayors for Climate and Energy*[51]. It aims to engage and support cities and towns to commit to reaching the EU climate mitigation and adaptation targets. It was launched in Europe in 2008 (with the name Covenant of Mayors) to gather local governments to achieve the EU climate and energy targets. In 2014 the EC launched Mayor Adapt engaging cities in the process of adaptation to climate change. These two initiatives merged in the Covenant of Mayors for Climate and Energy shortly after (2015). Extending its scope out of EU and joining with another city initiative, the Compact of Mayors, led to the establishment of "Global Covenant of Mayors for Climate and Energy", currently the world's largest movement for local climate and energy actions.

[51] https://www.covenantofmayors.eu/en/

Box 10: Catalogues of adaptation options

Adaptation aims to manage climate risk to an acceptable level, taking advantage of any positive opportunities that may arise. Several catalogues of adaptation options are available and can help the adaptation process by supporting the choice of the most suitable adaptation measure, considering different climate risks. Examples include:

- **Climate-ADAPT** providing a catalogue of potential adaptation options that can be explored by selecting a specific climate impact and adaptation sector of interest. Case studies providing illustrative and inspiring examples of implemented adaptation options across Europe are also reported.
- **weADAPT**, a collaborative platform on climate adaptation issues, developed and maintained by the Stockholm Environment Institute (SEI). It allows practitioners, researchers and policy-makers to access information, including adaptation options, and connect with one another.
- **Database of Private Sector Initiative on Adaptation**, developed by the UNFCC. It is a database of case studies developed under the Private Sector Initiative (PSI) of the Nairobi work programme, and features good practices and profitable climate change adaptation activities being undertaken by private companies (sometimes in partnership with NGOs or the public sector) from a wide range of regions and sectors.
- **Adaptation Option Library**, developed by the H2020 RESIN project (supporting decision-making for resilient cities). It is a searchable database of all kinds of adaptation measures, addressing climate risks in cities, including heat; pluvial, fluvial and coastal floods; and drought. Information can be explored by selecting different climate hazards, implementation scales, measure types and targets, heat/flood effectiveness, and cost-efficiency.
- **Urban green-blue grid**, aimed to make cities sustainable, resilient and climate-proof. The website and the design tool aim to help finding fitting measures also providing real implementation examples.
- **Natural Water Retention Measures (NWRM) Platform**, focused on nature-based green infrastructures solutions applied to the water sector. It gathers information on NWRM at EU level. Measures can be accessed by selecting a sector of interest; case studies with real implementation examples can also be explored.
- **RISC-KIT toolkit**, developed by the FP7-funded RISK-KIT aiming to reduce risk and increase resilience to low-frequency, high-impact hydro-meteorological events in the coastal zone. The toolkit includes the "Web-based Management Guide", containing a collection of prevention, mitigation and preparedness measures, with recommendations for their use. It focuses on innovative, cost-effective and ecosystem-based DRR measures.
- **Climate Innovation Window** developed by the H2020 BRIGAID project. It provides a window to showcase innovative measures to deal with a wide range of hazards (coastal and river floods, droughts, heatwaves, heavy precipitation, storms, wildfire and multi hazards).

- *Climate Alliance*[52]. It was funded in 1990 involving institutions of 12 municipalities from Germany, Austria and Switzerland as well as 6 indigenous organisations of the Amazon Basin. Now it is actively working to combat climate change with some 1,700 member municipalities and districts covering 26 European countries as well as a variety of regional governments, NGOs and other organisations.
- *100 Resilient Cities – 100 RC*[53]. Pioneered by The Rockefeller Foundation, 100RC is dedicated to helping cities around the world become more resilient to the physical, social and economic challenges. 100RC aims to help individual cities become more resilient, also facilitating the building of a global practice of resilience among governments, NGOs, the private sector, and individual citizens.
- *C40 Cities*[54]. It is a global network of large and innovator cities taking action to address climate change by developing and implementing policies and programs that generate measurable reductions in both greenhouse gas emissions and climate risks. C40 supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change.
- *Delta Alliance*[55]. This is an international knowledge-driven network organisation with the mission of improving the resilience of the world's deltas. The Delta Alliance provides a platform where people living and working in deltas can share their knowledge and benefit from each other's experience and expertise and as such contribute to an increased resilience of their delta region.

Investment and infrastructure

Certain climate-related actions will involve investment in protective infrastructure, such as seawalls and dikes or technologies needed to cope with other climate change impacts, as in the case of desalinisation facilities. In general, one should not give priority to such solutions, but should look in the first instance for less expensive 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. Examples of these changes include measures for buildings to withstand increased impacts from extreme weather events and transport systems that have to account for the increased risks of subsidence. Some of these investments will be in the public sector and some will be in the private sector.

The guidance to the private sector on how to address additional climate risks should be provided.

For public sector investments, a key aspect is funding, which is discussed in the next section.

Finance for realizing the vision

Rising sea levels will make coastal adaptation increasingly expensive. The question is – "Who will pay for coastal adaptation?" Public funds are limited, so in most cases, everybody is pointing to someone else. In the longer run it is to be expected that everybody will have to take the part of this cost, including the direct beneficiaries of these expensive measures, such as landowners, owners of the real estates, companies, entrepreneurs, as well as municipalities, regions, states and the society as a whole. The distribution model of financing must be discussed and agreed on. In the meantime, securing against flooding and other climate-related impacts needs to be integrated into planning. In addition, the

[52] https://www.climatealliance.org
[53] https://www.100resilientcities.org
[54] https://www.c40.org
[55] www.delta-alliance.org

awareness on future risks and costs needs to be brought to all investors constructing in the low-laying coastal zones or areas affected by other climate-related risks.

Financing adaptation to climate variability and climate change comes from national and international sources (including EU funding) and from the public and private sectors.

EU funding opportunities

To help achieve its climate goals, the EU mainstreams climate action into its whole budget: the Multiannual Financial Framework (MFF) for the period 2014-2020 ensures that at least 20% of the European expenditure contributes to climate objectives. A more ambitious effort (25%) is proposed for the next programming period (2021-2027)[56], to support the implementation of the Paris agreement and the commitment to the United Nations Sustainable Development Goals.

LIFE is the Programme for the Environment and Climate Action. It is considered the key funding channel for supporting capacity for adaptation and to step-up adaptation action in Member States. The LIFE Climate Action sub-programme supports projects in the development of innovative ways to respond to the challenges of climate change in Europe and it is focussed on increasing resilience to climate change[57].

The INTERREG programme[58] is aimed at addressing complex problems that transcend Member State boundaries and thus necessitate a common approach and multiple actors for their effective solution (EC, 2011). It includes programmes for:

- Cross-border cooperation (INTERREG A), supporting cooperation between NUTS III regions from at least two different Member States lying directly or adjacent to the borders.
- Transnational cooperation (INTERREG B), uniting larger territories at NUTS II level to promote better cooperation and regional development by a joint approach to common issues.
- Interregional cooperation (INTERREG C) works at the pan-European level to enhance exchange of experiences and best practices.

For the 2014-2020 programming period, the following INTERREG programmes cover the Adriatic-Ionian region, supporting projects directly or indirectly related to climate change adaptation:

- The *INTERREG V B Mediterranean* Programme (MED)[59]. It includes 10 EU Member States and regions facing the Mediterranean basin. The MED Programme 2014–2020 promote sustainable growth in the Mediterranean area by fostering innovative concepts and practices (technologies, governance, innovative services). It also encourages the sustainable use of natural and cultural resources and support social integration, through an integrated and territorially based cooperation approach. The programme explicitly considers climate change adaptation and risk management under the Priority Axis 2 (Fostering low carbon strategy and energy efficiency). Moreover, under Axis 3 (protecting and promoting Mediterranean natural and cultural resources) support environmental protection initiatives also considering the consequences of climate change.

[56] https://ec.europa.eu/clima/policies/budget/mainstreaming_en
[57] https://ec.europa.eu/clima/policies/budget/life_en
[58] https://ec.europa.eu/regional_policy/en/policy/cooperation/european-territorial/
[59] https://interreg-med.eu/

Box 11: Climate-KIC

Supported by the European Institute of Innovation and Technology, Climate-KIC is a Knowledge and Innovation Community (KIC), working to accelerate the transition to a zero-carbon economy. It identifies and supports innovation that helps society to mitigate and adapt to climate change.

Climate-KIC gathers partners from business, academia, and the public and non-profit sectors to create networks of expertise, through which innovative products, services and systems can be developed, brought to market and scaled-up for impact. To this scope it identifies, sources and places public and private funds that stimulate innovation on climate change fields, also directly providing calls for proposals.

- The *INTERREG V B Adriatic-Ionian* Programme (ADRION)[60]. It succeeded the INTERREG South East Europe (SEE) and the Adriatic IPA Cross-Border Cooperation Programme of the previous programming period (2007-2013). ADRION covers the entire extension of the EU Member States of Greece, Croatia and Slovenia, as well as 12 Italian regions and the four IPA Partner States of Albania, Montenegro, Serbia, Bosnia and Herzegovina. The area coincides with the region of The EU Strategy for the Adriatic and Ionian Region (EUSAIR). Within Priority Axis 2 of the Programme (Sustainable region), it supports cooperation in the fields of environmental protection, biodiversity management, ecosystem services and climate change adaptation, recognizing that the region is strongly affected by natural risks (floods, drought, fires, storms and earthquakes), enhanced by the climatic changes.
- The INTERREG V A Italy-Croatia Programme61. It is the financial instrument supporting the cooperation between the two European Members States territories overlooking the Adriatic Sea. The programme is focussed on the maritime assets, with the aim to increase the prosperity and the blue growth potential of the area. Under Priority Axis 2, Safety and Resilience, the programme supports investment for adaptation to climate change, including ecosystem-based approaches, and for addressing specific risks, ensuring disaster resilience and developing disaster management systems.

Other EU funds and financing institutions also support adaptation measures. For example, the European Investment Bank (EIB) finances projects specifically dedicated to climate change mitigation and adaptation across a variety of sectors, and provide a range of financial and advisory solutions[62]. The Connecting Europe Facility (CEF)[63] is a key EU funding instrument for targeted infrastructure investment at European level, and adaptation is one of the requirements for assessment of projects.

An extensive summary of funding opportunities for both Italy and Croatia can be found on the AdriAdapt platform[64].

National funding opportunities – Italy

At national level no resources are specifically dedicated to adaptation yet (*National Plan for Climate Change Adaptation,* PNACC, 2017)[65].

The national economic planning follows the partnership agreement[66] with the European

[60] http://www.adrioninterreg.eu/
[61] http://www.italy-croatia.eu/
[62] https://www.eib.org/en/projects/priorities/climate-and-environment/?lang=en
[63] https://ec.europa.eu/inea/en/connecting-europe-facility
[64] The Guidelines for financing can be found in Italian and Croatian language at adriadat.eu
[65] https://www.minambiente.it/pagina/consultazione-su-piano-nazionale-adattamento-cambiamenti-climatici
[66] https://ec.europa.eu/info/publications/partnership-agreement-italy-2014-20_en

Commission on funding through the European structural and investment funds. Under this partnership agreement, several National (PON) and Regional (POR) Operational Programmes managed by central or subnational administrations consider spending priorities in the field of the environment and sustainability, with some connections to climate change adaptation.

For example, adaptation is to some extent included in the Operational Programme for rural development (under Agricultural Fund for Rural Development) and for sustainable fisheries (under the European Maritime and Fisheries Fund). Other opportunities for adaptation include the Operational Programme for metropolitan cities, supporting projects of sustainable urban development and the Operational Programme for Infrastructures to increase resilience to climate change.

National funding opportunities – Croatia

As mentioned earlier, an obligation on the Member States was imposed that minimum 20% of the funds within the overall budget for the seven-year period 2014-2020 have to be planned and spent on investments related to climate change indicated, as part of the MFF for the period 2014-2020.

For this period Croatia aims to rely on disposal of funds within the European Regional Development Fund (ERDF), the Cohesion Fund (CF), the European Agricultural Fund for Rural Development (EAFRD) the European Maritime and Fisheries Fund (EMFF); etc. Although the National Climate Change Adaptation Strategy was to the largest extent financed through these funds, it is necessary to provide funds within the State Budget for the preparation of some specific measures. These mostly relate to regulatory and administrative activities.

Implementation of measures and activities for adaptation to climate change until 2040 in Croatia will be financed from several different public and private sources. Financial mechanisms for adapting to climate change will be established using national and international (European) funds from three sources:

- state budget,
- European structural and investment Funds, and
- the private sector (including public-private partnership).

The state budget includes the funds collected by the tax system, but also the funds collected from the auction of emission units managed by the national Environmental Protection and Energy Efficiency Fund.

Private Finance

Information on the amount the private sector spends on adaptation to climate change is very limited, although many private sector entities are certainly allocating resources to ensure their investments are climate resilient. The private sector is also providing climate risk insurance as part of the process of planning economic activities and making investment decisions. There are many risk management options that insurance may incentivize, such as flood proofing for buildings and property or retrofitting houses. For businesses, the link between an insurance product and a risk reduction incentive appears to be significant: the size of an insurance premium makes risk reduction activities with premium discounts more attractive.

Recent experience has shown that there is a role for public sector support in mobilizing private finance (OECD, 2017). This support can be provided by ensuring that private partners are better informed about the risks and have the technical capability to undertake the appropriate adaptation measures. In the case of insurance, public-private partnerships have been successful in providing coverage when a private company would not have been able to do so.

In coastal zones the private sector has a major role in investment in facilities that provide services such as recreation, tourism, housing, etc. When such investments face an increased risk from climate change, private investors will need to provide financing for adaptation to the extent that they directly benefit from it. The fact that some investments fulfil a “public good” (a sea wall for example may protect the property of more than one investor) shows that we need a combination

of public and private financing to ensure that the correct investments are made.

At the same time, situations exist in which public funds are not available for "public good" investments, while the private sector, which has the financial wherewithal, will not undertake the investment on its own. Innovative governance structures such as public-private partnerships (PPPs) can stimulate private sector co-financing (Tompkins and Eakin, 2012). PPPs arose as a way to share capabilities and risks between the public and private sectors (Schroeder *et al.*, 2013). The role of the municipality in PPPs consists of facilitating project development by removing barriers, while the private sector assumes part of the risk, provides funding and manages the project (Markandya *et al.*, 2015).

5.2 Acting

The lessons learned should be shared across the coastal communities and used to improve future plans. They apply especially in the domain of climate change, where there is not yet much experience with the implementation of actual policies and measures, and where such lessons are constantly being learned.

5.3 Monitoring and Review

It is critical that planners continuously track information on climate impacts since new data is appearing all the time. This data may affect proposed adaptation actions, which should be revisited periodically to incorporate any new knowledge.

It is also important to monitor the success of any action taken in achieving its goal, and what the impact has been of introducing relevant measures.

Monitoring should distinguish between:

- monitoring of the conditions in the plan area itself, including environmental, economic and social factors;
- monitoring the specific outputs of the action plan in terms of their costs, effectiveness and quality and if the actions continue to be viable in terms of the strategic objectives of the plan; and
- monitoring the wider outcomes of both actions and the policies of the plan as a vehicle in delivering sustainable development.

Each of the above relates back to the sustainability, impact and performance indicators identified earlier in the process (see chapter 3.3 Measuring success).

Conclusions

These guidelines take the reader through the different stages of coastal management and planning. They show how climate change, and climate change adaptation specifically, are relevant to each stage, what kinds of actions are needed to address climatic impacts, and what information are available in the literature on these effects, especially in Italy and Croatia. The guidelines also laid out the lessons learned from the management of climate change impacts in specific locations.

Climate change is a matter of major concern because of increasing temperatures, sea-level rise and the increased frequency and intensity of extreme events (droughts, floods, storm surges). Some of these impacts are already evident and they are projected to become more severe over the rest of this century.

Coastal zones are especially vulnerable to sea-level rise and storm surges, flooding in estuaries and deltas, and saltwater intrusion in freshwater systems. They are also affected by changes in the level and pattern of demand for tourism, land for residential purposes, fisheries, shipping and other coastal and marine uses; all these act as additional drivers which can exacerbate the effects of climate change.

Considering above elements, it is important to stress that:

- investment in vulnerable areas may prove to be unwise if assets are subject to damages from the effects of climate change and if climate-related risks are not properly taken in considerations,
- right information and incentives shall be given to public and private key stakeholders to make the best decisions.

The analysis of the location of vulnerable areas and what actions are justified to protect them has become a key part of mainstreaming climate change into coastal management. These guidelines provide examples for the Adriatic region, with specific focus on Croatia and Italy. Adaptation to climate change is a major activity in all countries and resources are available from different sources to finance it. The report provides details of these sources for EU members and other countries in the Adriatic region.

Appropriate adaptation policies and measures are first and foremost those that can be labelled as "no regrets". It is surprising how many climate adaptation measures have benefits other than those related to reducing climate impacts. They include lesser impacts from the current variability of weather and better management of land and other natural resources from a sustainability perspective. Looking for co-benefits (in the short and medium-term) can surely foster the implementation climate change adaptation measures.

Lastly, our knowledge of climate change is expanding all the time, but we are still making decisions in a framework of uncertainty. Hence, it is important that the system be flexible and open to new information. Methods for decision making with incomplete and dynamic information must be part of the tool kit that planners have at their disposal.

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The EU Interreg AdriAdapt Project aims to improve local climate change adaptation capacity in Adriatic region by creating an information platform that provides access to guidance, data and tools that will help local authorities to take adequate policy measures and develop plans to increase resilience in urban and coastal areas. The AdriAdapt project was carried out from 2019 to 2021 by six partner institutions from Italy and five partner institutions from Croatia.