

# POLICY PAPER

Elaborated in the framework of



## COASTAL ADAPTATION TO CLIMATE CHANGE:

### HOW TO WORK WITH NATURE?

Coordinated by

In partnership with







## CONTEXT FOR THE ELABORATION OF THIS POLICY PAPER

The Conservatoire du littoral, in partnership with the Ocean & Climate Platform, Eurosite – the European Land Conservation Network, the Conference of Peripheral Maritime Regions (CPMR), the Parliamentary Intergroup « Sea, Rivers, Islands and Coastal Areas » (SEARICA), the Overseas Countries & Territories Association (OCTA) organised an event/workshop on the adaptation of coastal areas to climate change, in Marseille and Hyères from June 15th to 17th in the framework of the of the French Presidency of the Council of the European Union (FPEU)<sup>1</sup>.

This event reinforced the cooperation between European and Mediterranean Coastal Agencies<sup>2</sup> and other coastal stakeholders by developing reflections and strategies on adaptation of coastal territories to climate change.

The Steering Committee of this event has decided to set-up a Policy Paper containing recommendations and strategies developed through exchanges with Coastal Agencies before and jointly during the event.

This Policy Paper aims at addressing issues relating to adaptation to climate change in coastal areas (coastal mainland and overseas territories), considering both:

- *Natural/unbuilt areas* (undeveloped areas, naturally protected areas, agricultural land, forests, natural heritage and landscape, etc.)
- *The interaction between natural and urbanised/built areas* (cities, roads, harbours, airports, tourism infrastructures exposed to climate change impacts, etc...)

It is intended for representatives of the European Union, Member States, coastal regions and cities in order to provide specific recommendations elaborated in concertation and the necessary changes so to develop a better adaptation strategy to climate change. These recommendations were developed to guide the planning and implementation of adaptation measures at all levels of governance.

<sup>1</sup> This event was not organised by the French Government. However, it is authorised by the Government to use the emblem of the French Presidency of the Council of the European Union.

<sup>2</sup> Informal network of public and private organisations working for the protection and/or development of coastal territories in Europe and the Mediterranean basin, led by the Conservatoire du Littoral since 2015.

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This Policy Paper was developed in the framework of the French Presidency of the Council of the European Union for the first half of 2022, which has the ambition of developing a sustainable Europe.



## INTRODUCTION

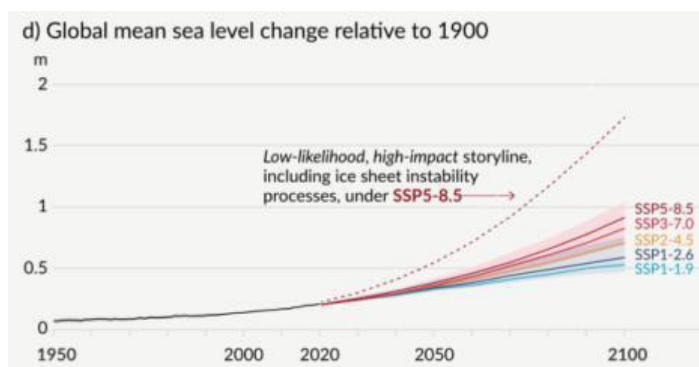
### A - CONTEXT

Adaptation to climate change is one of the greatest challenges of our time, especially in coastal areas, a zone that is exposed to the majority of its related impacts. These impacts entail retreating coastlines exacerbated by retreating coastlines linked to sea level rise, accelerated erosion in some areas and an increase in the frequency and severity of storms and coastal flooding, salt water intrusion making rivers and aquifers brackish as well as the degradation of marine and coastal ecosystems.<sup>1</sup>

Since 1850, the earth's temperature has risen by more than 1.1 °C.<sup>2</sup> Global warming is leading to fundamental changes in coastal zones worldwide. According to the Intergovernmental Panel on Climate Change (IPCC)'s special report on the Ocean and the Cryosphere in a Changing Climate (SROCC), global warming caused massive ice melting, as well as expansion and warming of the Ocean.<sup>3</sup> This has led to global sea level has risen by 15cm over the 20th century and mean sea levels could rise up to 110cm by 2100.<sup>4</sup>

On the other hand, global change is impacting on oceans and coasts: acidification of the oceans in link with CO<sub>2</sub> emissions, heat waves, droughts, fires and water shortages, in addition to the socio-economic consequences and cross-border political tensions...<sup>5</sup> These phenomena impact on biodiversity and ecosystems as well as risks faced by small islands, estuaries and coastal areas. For example, across the Mediterranean basin, temperatures have risen by 1.5 degrees since 1850, a rate faster than at the global scale, with an increase in extreme precipitation, rapid marine submersion.<sup>6</sup>

The second part of the 6th IPCC report, released in 2022 and which deals with the vulnerability to climate change and adaptation measures, estimates that coastal territories will be increasingly sensitive and exposed to chronic flooding and storms between now and 2050 and, in the longer term (2050 to 2150), to an increase in salinization, erosion and permanent flooding.<sup>7</sup> The effects of climate change will pose existential threats to islands, low-lying coastal areas and coastal cities, with associated risks for coastal communities and infrastructures. In order to minimise the impacts of climate change, it is essential to mitigate and adapt at the same time. In order to minimise the impacts of climate change, it is paramount to concurrently deploy ambitious mitigation and adaption action. Such adaptation measures are beginning to be deployed in coastal areas. However, there is increasing certainty that adaptation solutions are limited facing the speed of climate change, and that it will not always be possible to implement flexible solutions.<sup>8</sup> Indeed, these measures alone can only be effective in a favourable scenario in combination with a significant reduction in greenhouse gas emissions with the hope to stabilise sea level rise.



Source : IPCC AR6. Figure SPM.8

1 IPCC Special Report on Ocean and Cryosphere in a Changing Climate 2019.

2 IPCC Working Group I report, Climate Change 2021: the Physical Science Basis.

3 IPCC Special Report on Ocean and Cryosphere in a Changing Climate 2019.

4 IPCC AR6 WGI Climate Change 2021: Physical Science Basis.

5 IPCC AR6 WGI Climate Change 2021: Physical Science Basis.

6 Climate and Environmental Change in the Mediterranean Basin Current situation and Risks for the Future, First Mediterranean Assessment Report by the Mediterranean Experts on Climate and Environmental Change, p.4.

7 IPCC AR6 WGII Climate Change 2022: Impacts, Adaptation and Vulnerability, Summary for Policy Makers, p.17.

8 IPCC AR6 WGII Climate Change 2022: Impacts, Adaptation and Vulnerability, Technical Summary, p.55.



**Interview with Gonéri le COZANNET***Bureau de Recherches Géologiques et Minières (France)*

If we can reduce greenhouse gas emissions and avoid the collapse of the Antarctica, sea level rise can be stabilised at 4 millimetres per year which generally allows for more adaptation options, including ecosystem-based soft options.

It is also estimated that beyond 1.5 C° of warming, the impact will be irreversible for certain marine and coastal ecosystems such as corals. This applies as well as for human activities, cultures, heritage and well-being.

The second publication of the Sixth Assessment Report of the IPCC indicates that it is still possible to curb climate change and make coasts resilient. However, the window for action is short/rapidly closing and requires significant and immediate changes.

## **B- INTERNATIONAL, EUROPEAN AND FRENCH PRESIDENCY OF EUROPEAN UNION (FPEU) OBJECTIVES**

Adaptation to climate change in the coastal zone is part of the 2030 Sustainable Development Goals (SDGs) adopted by the United Nations pursuing the objective to address the global challenges faced by people, including the following:

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**Goal 11:** Make cities and human settlements inclusive, safe, resilient and sustainable

**Goal 13:** Take urgent action to combat climate change and its impacts

**Goal 14:** Conserve and sustainably use the oceans, seas and marine resources for sustainable development

**Goal 15:** Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

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The 26th UNFCCC Conference of parties (COP26), held in 2021 in Glasgow, increased the commitments of all countries in relation to the Paris Agreement. It reaffirmed the Paris Agreement's ambition to limit global warming to 1.5 °C, expressing concern about the 1.1 °C of warming already reached. In order to achieve these goals, the parties call for a massive reduction in greenhouse gas emissions. In addition, the Glasgow Climate Pact calls on high income countries to double financial support to low and middle income countries for adaptation to climate change and building territorial resilience. Finally, the pact recognises the increasing impact that climate change is having on human populations, particularly in low and middle-income countries. In order to discuss the financing of activities to prevent, minimise and address the loss and damage associated with the impacts of climate change, the "Glasgow Dialogue" was launched.<sup>9</sup> In addition to the Glasgow Climate Pact, countries made significant announcements, including a commitment by 137 countries to halt the loss of forest area and land degradation by 2030. 103 countries signed the "Global Methane Pledge" pledging to limit their methane emissions by 30% by 2030, compared to 2020 levels.

Within the European Union (EU), the challenge of adaptation to climate change in coastal areas has been addressed on several occasions. Firstly, in 2002, the European Parliament and the Council adopted a recommendation on the implementation of an integrated coastal zone management strategy in Europe, particularly with regards to the threat to coastal zones and the effects of climate change. Thus, the European Union formulated 8 principles to be considered considering the elaboration of national strategies for integrated coastal zone management. Notably the aspects of a broad global perspective taking into account the interdependence and disparity of natural

systems and human activities as well as a long-term perspective based on the precautionary principle and the needs of present and future generations. Under the 2007 EU Flood Directive on the assessment and management of flood risks, Member States were obliged to assess rivers and coastlines for flood risk, map the areas at risk and assess the populations at risk in order to take adequate measures to reduce these risks.<sup>10</sup>

In the framework of the European Green Deal, the Commission pursues the objective of a climate-resilient society in 2050 which will be fully adapted to the unavoidable impacts of climate change. It has published a strategy for adaptation to climate change in 2021, supporting more systemic adaptation in policy making at all levels and in all sectors and believes that Nature-based Adaptation Solutions should be promoted to strengthen coastal protection.<sup>11</sup> Also as part of its Biodiversity 2030 strategy, the European Commission is proposing a legally binding EU text setting out nature restoration targets to increase biodiversity, mitigate and adapt to the effects of climate change and prevent and reduce the impacts of natural disasters.<sup>12</sup> Stopping climate breakdown is also a transversal priority of the French Presidency of the Council of the European Union, committed to continue implementing the strategy of the "European Green Deal" by strengthening measures to preserve and restore biodiversity and to promote actions to tackle climate change carried out by farms and forestry companies.

In the framework of UNEP/MAP Barcelona Convention, Protocol on Integrated Coastal Zone Management for the Mediterranean has been developed and today ratified by 11 countries and the EU. This is the first regional legal document in the world on

9 <https://www.un.org/en/climatechange/cop26>

10 [https://ec.europa.eu/environment/water/flood\\_risk](https://ec.europa.eu/environment/water/flood_risk)

11 <https://eur-lex.europa.eu/legal-content/FR/TXT/PDF/?uri=CELEX:52021DC0082&from=EN>

12 [https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030/eu-nature-restoration-targets\\_en](https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030/eu-nature-restoration-targets_en)



coastal management. It invites countries to prepare their national coastal strategies, plans and programmes (Article 18). It also invites Mediterranean countries to establish a zone where construction is not allowed and proposes a minimum width for this zone of a 100m from the highest winter waterline, taking into account the impacts of the climate change (Article 8). France was among the countries that led the development of this Protocol and one of the first that ratified it.





## CHAPTER 1: ADAPTATION IN COASTAL TERRITORY PLANNING

### INTRODUCTION:

As coastal territories involve environmental but also human and socio-economic issues, develop a long-term planning strategy is necessary in order to make them resilient to climate change. Thus, it is crucial to take into account the different impacts of climate change on the coastal area in the planning and implementation of adaptation actions against climate change.

### CURRENT SITUATION AND DATA :

Over 100,000 European citizens are currently exposed to coastal flooding every year. If no adaptation measures are taken, or if they are delayed, this number could reach 1.6 to 3.9 million by the end of the century.<sup>13</sup> In Europe, approximately 50 million people live in low elevation coastal zones. In 2004, a European study estimated that over 20 % of the European coasts were subject to erosion. In France, ¼ of the metropolitan coastline is subject to erosion, of which 270 km is retreating at a rate of more than 50 cm per year.<sup>14</sup> The Catalan coastline is also at risk and it is estimated that, by 2060, 140 km of coast will be vulnerable to the effects of storms. In addition, in France alone, 9 million jobs are exposed to river overflows and more than 850,000 to marine inundation.<sup>15</sup> According to a study conducted by the *Environment Agency*, in the United-Kingdom more than 700 properties could be lost by 2030 due to erosion while 247,000 businesses and homes are exposed to a high risk of coastal flooding.<sup>16</sup>

**In view of the urgency, adaptation strategies to address the impacts of climate change in coastal areas need to be reinforced.** Most EU Member States and regional governments have developed adaptation strategies for their

coastal zone, at national, regional and local scale. For instance, France adopted in 2012a *national strategy for integrated coastline management*, reinforced in 2021 by certain provisions of Climate and Resilience Law, promoting the approach of “living with the sea”, rather than against it. This national Strategy needs to be declined at local level through coastal zone management strategies to effectively reduce the vulnerability of people, properties and activities to coastal erosion. In other countries, some strategies exist at a regional scale. For example, in Germany, the *Masterplan Coastal Protection of the Federal State Schleswig-Holstein* foresees adaptation to climate change in the coastal zone of Schleswig-Holstein by 2100 based on the latest scenarios of the IPCC report. In the United-Kingdom, *Shoreline management plans* have been developed by the *Coastal Groups*, with the objective to identify the most sustainable approaches to managing flood and coastal erosion risks in the short (20-years), medium (50-years) and long (100-years) timeframe. In the Flanders region of Belgium, the *Masterplan for coastal safety* was developed in 2011 to protect the Flemish coast from the effects of millennial storms and a sea level rise of up to 30cm by 2050. In 2017, the Flemish government decided to define a new long-term vision “Kustvisie” to develop the socially most accepted measures necessary to gradually protect the Flemish coast and its hinterland on the long term against a sea level rise of up to 3m in the long term. The Catalan Government has started to develop a Master Plan for the protection and management of the Catalan coast with the objectives leadoff promoting coastal adaptation to climate change, notably through conservation of natural beaches and coastal bodies, preservation and restoration of ecosystems as well as prevention and reduction of natural and anthropogenic risks.

<sup>13</sup> Michalis Voudoukas et al, Economic motivation for raising coastal flood defenses in Europe, 2020.

<sup>14</sup> Territoires littoraux résilients. Des solutions fondées sur la nature, septembre 2021. Publié par la Direction générale de l'aménagement, du logement et de la nature (DGALN°, p.5.

<sup>15</sup> <https://www.caissedesdepots.fr/blog/article/trait-de-cote-et-politiques-de-relocalisation>

<sup>16</sup> Environment Agency report Managing flood and coastal erosion risks in England (1 April 2014 to 31 March 2015).





**There are several strategies to adapting coasts to the challenges of climate change. Different types of adaptation responses to sea level rise can be classified as:** hard solutions, soft solutions, accommodation to reduce vulnerability, ecosystem-based adaptation and managed coastal retreat/realignment.<sup>17</sup> Adaptation approaches should take into account different urban and economic settings, such as : coastal cities, small and medium-sized coastal towns, small and large seaside resorts, seaside resorts with a city centre located in the hinterland.<sup>18</sup> Furthermore, it is crucial to consider existing legal planning instruments in developing adaptation solutions as well as the effects of acceleration of climate change. It is most of all necessary to consider the more rapid scenarios of sea level rise, which may make it impossible to anticipate the necessary structural changes.<sup>19</sup> **Rather than a single strategy, the development of a hybrid response, that combines both natural options and infrastructure-based approaches, may allow for a more flexible and integrated protection of coasts enabling a better adaptation in the face of uncertainty.**<sup>20</sup>

**The Adriadapt project has developed a handbook for the resilience of the Adriatic coast** indicating the different existing coastal typologies, climate change data and projections as well as the different solutions to be implemented: societal adaptation measures, green measures and hard solutions.

The **Masterplan for coastal safety** in Belgium pursues the objective of a sustainable development of the Flemish coastal zone, taking into account the natural dynamics of the coast it incorporates both sand recharging as well as hard solutions. Working within nature conservation in the Flemish region, **Natuurpunt** has developed in a participatory process with local volunteers, members and scientists a vision for nature 2050, notably on coastal adaptation to climate change. This vision advocates a blue economy and the strengthening of ecosystems in the coastal zone, including justifying hard interventions if necessary, but combined with dunes in front of dykes and natural dunes intersecting the coastal cities and creating a green grid/corridor beneficial for biodiversity.

<sup>17</sup> Bongarts Lebbe et al., Designing coastal adaptation strategies to tackle sea level rise, *Frontiers in Marine Science*, Frontiers Media, 2021, pp.740602.p.2-4.

<sup>18</sup> Rocle et al., 2020, Paving the way to coastal adaptation pathways: An interdisciplinary approach based on territorial archetypes, p.9.

<sup>19</sup> Rocle et al., 2020, Paving the way to coastal adaptation pathways: An interdisciplinary approach based on territorial archetypes, p.16.

<sup>20</sup> Bongarts Lebbe et al., Designing coastal adaptation strategies to tackle sea level rise, *Frontiers in Marine Science*, Frontiers Media, 2021, pp.740602.p.7.





**The Masterplan Coastal Protection of the Federal State Schleswig-Holstein** includes raising of dykes in places where human activity is at stake, but also no action in natural areas without human issues. For example, it prohibits construction on steep banks up to 150m along the eroding coast.

**Interview with Birgit MATELSKI**  
**Coastal Protection and National Park Authority**  
**Schleswig-Holstein (Germany):**

We only implement coastal defence measures at places where there are human issues. In areas where there is no human impact, we let nature interact by itself.

**The Shoreline management plans** in the United Kingdom define 4 possible management policies that can be applied to each stretch of shoreline and across 3 timeframes: hold the line, no active intervention, managed realignment and advance the line.

In France, the Conservatoire du littoral integrates issues related to climate change in its vision and 2015-2050 intervention strategy, both in terms of intervention areas and management guidelines,

particularly the need to adapt to changes. In 2011, it also carried out a study with 3 global scenarios on 5 fictitious territories representing the different coastal issues in France, imagining a rise in sea level of 50cm by 2050 with scenarios based on different actions: resist, suffer or adapt.<sup>21</sup>

**The Interreg North Sea Region: Building with Nature** project goal is the development and dissemination of climate change adaptation strategies comparing different adaptation mechanisms and relocation studies.

**In order for an adaptation strategy to be effective, it needs to be implemented at a local scale with tangible implementation measures and ensuring it responds to the needs and desires of local communities.** For example, in England, Wales and Northern Ireland, the *National Trust* has developed Coastal adaptation strategies (CAS) for the 90 sites most at risk from the effects of climate change over the next 100 years. Each CAS is defined site by site and recognises the risks faced from the forecasted coastal change at each site, as well as the need for involvement of the local community. These CAS define local level adaptation solutions in alignment with the relevant regional scale shoreline management plans.

21 Livret « Le Conservatoire du littoral face au changement climatique », 2013, p.10-13.

**Interview with Tony FLUX***National Trust for England, Wales and Northern Ireland (UK):*

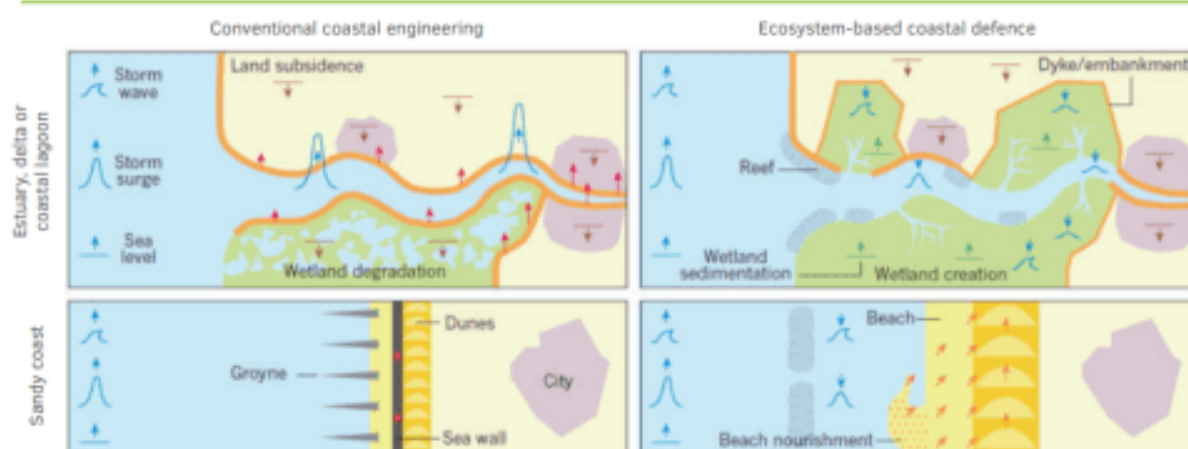
There is a need to be proactive rather than reactive.

**The Coastal Adaptation Plan for Sibenik-Knin** region in Croatia, developed in line with the ICZM Protocol for Mediterranean, extends to 2030, has defined a management plan for the coastal zone, ensuring the development of the resilience of coastal systems to the impacts of climate change. The proposed measures are to preserve the remaining natural areas as well as measures to take into account soil irrigation, forest fire risks management and measures for all economic sectors as well as agricultural areas. Upon adoption of this plan, two more regions and 2 cities in Croatia developed and adopted their Coastal Plans, in line with the requirements of the ICZM Protocol. In 2021, in the framework of the GEF MedProgramme a Coastal Plan development has been launched in the Kotor Bay (Montenegro) and in Moroccan region Tanger-

Tetouan-Al Hoceima. Although Italy hasn't ratified the Protocol yet, several Italian regions, such as Emilia Romagna, Marche, Sardinia, etc. have prepared their integrated coastal management plans, or similar planning documents inspired by the ICZM Protocol..

**Nature-based Solutions (NbS) have rarely been taken into account in adaptation strategies**, despite the services and co-benefits they provide. NbS are actions to protect, sustainably manage and restore natural and modified ecosystems in ways to address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits.<sup>22</sup> Nature-based Solutions can potentially adapt more easily to climate change impacts, in comparison to hard solutions that cannot always be modified to address sea level rise, require maintenance and may create erosion in other places.<sup>23</sup> By reducing the intensity of waves and impacts caused by storms, and by retaining sediments, NbS are invaluable allies in adapting to sea level rise, at a low cost.<sup>24</sup>

Figure 2: Conventional vs. nature-based coastal defence measures. Blue arrows indicate the increase/decrease of storm waves, storm surge and sea level (as specified); red arrows indicate the need for maintenance and heightening of dykes/embankments/sea walls with sea-level rise; and brown arrows indicate land subsidence.



<sup>22</sup> IUCN 2016

<sup>23</sup> Davis et al., 2015, Recreate Policy Brief- Coastal Protection and Suds- Nature-based solutions, p.5.

<sup>24</sup> Timmerman et al., 2013: Ecosystem-based coastal defence in the face of global change, Nature 504, 79-83.



In order to demonstrate the effectiveness of coastal NbS based on natural coastal ecosystems, a call for projects from the French Ministry of Ecological Transition on *Resilient Coastal Territories-Nature-based Solutions to Coastal Change and the Effects of Climate Change* supported 9 projects at a local scale, in which are implemented actions to restore and preserve coastal ecosystems. One example has been the relocation of socio-economic structures outside flood risk areas in the Saône valley and restoration of wetlands in the lower valley.

**The legal framework in the coastal zone does not always allow for effective adaptation to climate change and can be an obstacle to the implementation of measures.** Specifically, the dense and linear urbanisation of coastal areas does not always permit a choice between different adaptation approaches. However, definition of a no-build zone regime already can make it possible to curb urbanisation in coastal areas. In France, since 1986, the coastal law has defined a 100m coastal strip that cannot be built on.<sup>25</sup> In addition, coastal areas vulnerable to the impacts of climate change can be identified. For example, using evidence from the *Shoreline management plans*, *Coastal change management areas* are defined by some local authorities in England and Wales, identifying areas where the coastline will change over the next 100 years. This enables informed decisions to be made by authorities when approving planning permissions and developments in these areas. In France, the climate resilience law has introduced

new measures to take into account the retreat of the coastline in local urban planning. A list of 126 municipalities was published in 2022 which will have to take measures to combat erosion, prohibiting new construction in exposed areas within 30 years.<sup>26</sup>

**Finally, implement measures to relocate populations remains complex.** More and more studies are being carried out on coastal retreat issues, but property and land values in some coastal areas remain very high. Beyond the costs, relocation also poses many problems. The existing legal tools only allow for purchase by mutual agreement, compulsory purchase or expropriation or “laissez faire” leading to the incorporation of the property into the public maritime domain.<sup>27</sup> In France, a recent real lease for adaptation to coastal erosion (BRAEC) can be introduced in areas exposed to coastline recession for a long period, between 10 and 90 years depending on the timeframe of the development operation and the “expected life” of the land.<sup>28</sup> It is also important to consider the impact of relocation on unbuilt areas (natural or agricultural areas). Finally, managed retreat is difficult to implement due to a variety of psychosocial factors – such as attachment to a place, sense of identity tied to the coastline, etc., economic factors underlying the local economy, along with an inaccurate perception of risk which can be linked to poor information, positivity bias and/or gradually fading memory of past extreme events.



<sup>25</sup> Loi n° 86-2 du 3 janvier 1986 relative à l'aménagement, la protection et la mise en valeur du littoral.

<sup>26</sup> Décret n° 2022-750 du 29 avril 2022 établissant la liste des communes dont l'action en matière d'urbanisme et la politique d'aménagement doivent être adaptées aux phénomènes hydrosédimentaires entraînant l'érosion du littoral

<sup>27</sup> Lambert, Marie-Laure, 2015, Le recul stratégique : de l'anticipation nécessaire aux innovations juridiques, p.2.

<sup>28</sup> <https://www.ecologie.gouv.fr/adaptation-des-territoires-aux-evolutions-du-littoral>



**Interview with Adrien PRIVAT**  
*Conservatoire du littoral (France):*

We must avoid making the legal framework for relocation too flexible at the risk of opening a Pandora's box allowing relocation to the detriment of natural areas. Each operation must be thought through and adopted locally by all the actors. This may take time, but it is essential.

Furthermore, the legal framework does not recognise Nature-based Solutions as a protection system. For example, in France, protection of an area exposed to the risk of flooding can only be achieved by embankments (dykes).<sup>29</sup> NbS have to be integrated into the territorial adaptation plans. As a project leader in territorial projects, the Conservatoire du littoral promotes the dynamic management of ecosystems on coastal and lake shores, while ensuring the protection of the population with the creation of a new embankment (dyke) set back from the sea and leaving formerly reclaimed land to interact freely with the sea.<sup>30</sup>

**Interview with Patrice BELZ,**  
*Conservatoire du littoral (France):*

The problem is that the flood prevention and action programme (PAPIs) are only on a very local scale and do not take into account NbS alternatives. In the Brouage marsh, there was no PAPI because there were no human issues even though there was socio-economic activities.

Additionally, implementing Nature-based Solutions remains complicated due to a heavy administrative procedure and a lack of technical expertise, as this approach is still in its infancy.

**Interview with Sophie SEJALON**  
*Conservatoire du littoral (France):*

The authorisations required to carry out renaturation work are the same as those required for riprap work.

**RECOMMENDATIONS:**

- **Develop dynamic, hybrid and long-term coastal climate change adaptation strategy at a national, regional and local scale with short & medium milestones**

It is crucial to develop local, national or regional strategies to support the adaptation of coastal cities and territories to the impacts of climate change in a sustainable and long-term manner seeking coherence, coordination and collaboration among them. These strategies need to be dynamic and flexible, so to allow a rapid adaptation in the event of major and rapid changes. Combining different types of adaptation responses across time and space further enables the elaboration of robust adaptation systems, tailored to their territories and that allow for long-term flexibility. In the range of adaptation options, the use of NbS should be prioritised whenever possible. The definition of tipping points which will trigger the implementation of measures when thresholds have been exceeded and driving irreversible changes in the coastal area is instrumental in implementing dynamic adaptation.. In addition, the strategy should define



<sup>29</sup> Article R.562-13 du Code de l'environnement.

<sup>30</sup> Livret « Le Conservatoire du littoral face au changement climatique », 2013, p.49.



adaptation pathways with sequences of actions to implement progressively.

Sea level rise and certain other impacts of climate change are long-term processes that cannot be reversed through mitigation action. It is thus necessary to develop adaptation strategies that reflect this reality and are rooted in long-term territorial planning, accounting for the next 100 years. Short and medium-term milestones at 10, 30 and 50 years facilitate a gradual and anticipated transition.

### **Interview with Peter VAN BESIEN** *Afdeling Kust (Belgium):*

Robust basic coastal protection is needed based on the most likely sea level rise scenario. There is also a need to establish a roadmap with an elaborate plan for low probability but high risk sea level rise scenarios and set up tipping points<sup>31</sup> with initiation of actions depending on the time taken to design and build them. This road map should be adaptative, to integrate as the future sea level surveys and the updates in sea level rise scenarios.

### **• Implement of coastal adaptation measures at the right scale**

When a municipality or authority decides to develop a coastal zone management plan that includes adaptation measures, natural processes should be considered across a larger scale than just the municipal scale; instead the hydro-sedimentary scale should be used in order for adaptation measures to be successfully implemented. Furthermore, any implemented actions should consider impact on the connectivity of coastal ecosystems, including within the hinterland, particularly when considering relocation inland of infrastructure and properties.

### **• Develop legal and financial tools to facilitate managed retreat of infrastructures and properties at risk in coastal areas**

Establish legal frameworks at national or regional scale is crucial to support the anticipated managed retreat of infrastructures and properties that are or will be exposed to the impacts of climate change in coastal areas. Given that the coastline is densely urbanised and subject to further population growth, implementing no-build regimes is critical to stop urban expansion in areas where it is still possible. For example, based on the principle of the 100m strip of inconstructibility in place in the countries of the Mediterranean basin, the European and International Delegation of the Conservatoire du littoral advocates the evolution of this strip towards a “100-year strip” in order to take into account the evolutions of the coastline that will take place over the coming decades and to take them into account on a scalar basis in shoreline development and preservation project. Innovative tools can support this rationale, such as a real lease of adaptation to climate change and other tools allowing temporary, reversible occupation of territories to facilitate relocation over time.

In addition to facilitate managed retreat, the legal framework should also facilitate the public and more generally non-commercial purchase of land in coastal areas in order to both prevent urbanisation and enable environmental conservation. This could be through setting up coastal agencies empowered to purchase land such as the Conservatoire du littoral or the Conservatoria delle Coste della Sardegna. For example, in order to carry out the functions of safeguarding and recovering the part of the coastline most threatened by urbanisation, Catalonia is in the process of setting up a coastal agency attached to the nature conservation agency to enable the acquisition of priority private land.

<sup>31</sup> Definition IPCC AR6 WGI Climate Change 2021: Physical Science Basis: a critical threshold beyond which a system reorganizes, often abruptly and/or irreversibly.



- **Establish a streamlined administrative procedure for the implementation of measures to re-naturalise or restore natural areas**

In order to facilitate the re-naturalisation of coasts and restoration of natural areas that can play a key role in coastal protection, it is recommended that the consenting required to carry out such measures be simplified. Consideration should be given to the development of a clearly defined list of restoration approaches. Making the nomenclature more consistent could facilitate the work of consenting authorities.

- **Enable the development of strategies involving informed local communities to lead to long-term shared commitments**

To ensure that coastal adaptation meets the needs and aspirations of communities and enables the realisation of a desirable future, it is essential to involve all stakeholders in the definition of adaptation plans. To this end, it is essential to identify all the stakeholders in a territory, to ensure their access to the appropriate information and to provide an integrated mechanism for their involvement in the decision-making process. In addition, coastal adaptation strategies should be popularised to be better understood, appropriated and accepted by civil society.





## CHAPTER 2: PRESERVATION OF COASTAL NATURAL, UNBUILT AREAS AND THEIR SERVICES

### INTRODUCTION:

At the boundary between land and sea, the undeveloped natural, agricultural or forest areas of the coastal zones provide ecological, cultural and socio-economic benefits. On the one hand, coastal ecosystems are home to a rich and varied biodiversity. On the other hand, these ecosystems provide an enormous diversity of services. The preservation of these areas is crucial to ensure the resilience of the coastal zone to the impacts of climate change.

### CURRENT SITUATION AND DATA :

**Natural areas and biodiversity are being lost, as they are exposed to the effects of climate change and human action.** In 2010, only 7% of coastal habitats and 13% of European coastal species were found to be in a good conservation status.<sup>32</sup> In the Mediterranean, the natural terrestrial aridity is being exacerbated by rising land and sea temperatures as well as a lack of precipitation and rising sea temperatures, and so is seen as the greatest threat to the diversity and survival of terrestrial and marine ecosystems.<sup>33</sup> High anthropogenic pressure on coastal natural areas leads to degradation of these areas. Furthermore, these areas have a higher population density and a higher number of uses than the rest of the territory. In France, 17% of the surface area of coastal municipalities is artificial, mainly at the expenses of agricultural lands, which have decreased by 25% between 1970 and 2010.<sup>34</sup>

**The combination of anthropogenic pressure and the impacts of climate change is accelerating the loss of biodiversity.** For example, the area of seagrass meadow is declining at a rate of 1.5% per year worldwide<sup>35</sup> and up to 5% per year in the Mediterranean due to water pollution, the construction of coastal infrastructures, the spread of invasive species, as well as changes in currents and increased storminess. This is also true of coastal wetlands. They are declining, due to reforestation, urbanisation, conversion of land to agricultural use and the creation of water bodies.<sup>36</sup> More than 87% of the world's wetlands have been destroyed since the beginning of the 19th century and in France alone more than 67% of wetlands have disappeared since the 1970s.<sup>37</sup>

**The retreat of the coastline due to climate change and direct human activity is further driving to a loss of land and subsequent modification of terrestrial species and natural areas.** In the European Union, in 2004, more than 20% of the European coastline was subject to erosion.<sup>38</sup> In France, more than a quarter of the coastline is subject to erosion with varying degrees of intensity. It is estimated that the retreat of the coastline is linked to the loss of more than 30km<sup>2</sup> of surface area.<sup>39</sup> In the UK, 28% of the coastline in the last 50 years is subject to coastal erosion of more than 0.1m/year.<sup>40</sup> Agricultural areas are also strongly affected by the impacts of climate change. Currently, over 20% of the world's agricultural land is affected by soil salinization. Adaptation to climate change also requires the relocation of assets and populations at risk. This relocation may be at the expense of undeveloped areas, including agricultural land and natural areas.<sup>41</sup>

32 European Environment Agency Report -2013, Balancing the future of Europe's coasts – knowledge base for integrated management, p.17.

33 Cramer et al., 2018, Climate change and interconnected risks to sustainable development in the Mediterranean.

34 <https://www.ecologie.gouv.fr/adaptation-des-territoires-aux-evolutions-du-littoral>.

35 <https://ocean.si.edu/ocean-life/plants-algae/seagrass-and-seagrass-beds>

36 European Environment Agency Report -2013, Balancing the future of Europe's coasts – knowledge base for integrated management, p.18

37 <http://www.zones-humides.org/theme-de-la-journee-mondiale-des-zones-humides>

38 Vivre avec l'érosion côtière en Europe : Espaces et sédiments pour un développement durable Bilans et recommandations du projet EUROSION, 2004, p.3.

39 [http://www.geolittoral.developpement-durable.gouv.fr/IMG/pdf/evol\\_surface\\_perdue.pdf](http://www.geolittoral.developpement-durable.gouv.fr/IMG/pdf/evol_surface_perdue.pdf).

40 Blott, S.J., Duck, R.W., Phillips, M.R., Pontee, N.I., Pye, K. and A. Williams, 2013. United Kingdom. In: Pranzini and Williams (eds), Coastal erosion and protection in Europe, Routledge, Oxon, pp. 173-208.

41 Manzoor Qadir, Emmanuelle Quillérou, Vinay Nangia, Ghulam Murtaza, Murari Singh, et al.. Economics of salt-induced land degradation and restoration. Natural Resources Forum, Blackwell Publishing, 2014, 38 (4), pp.282-295. ff10.1111/1477-8947.12054ff. ffhal-01954413f.





**Nevertheless, these ecosystems and natural coastal areas provide many services, with real benefits obtained for humans.** They provide provisioning services in terms of food and freshwater resources, as well as cultural and economic services, notably in terms of tourism and environmental education and awareness.<sup>42</sup> They also provide regulating services, including air quality, climate, water storage and quality, erosion protection and disaster mitigation.<sup>43</sup> **Coastal ecosystems provide important benefits, notably in terms of coastal protection:** for example, mangroves provide coastal protection by attenuating wave forces and trapping sediments<sup>44</sup>, whilst eelgrass beds also provide protection against coastal flooding.<sup>45</sup> The same goes for seagrass meadows, which stabilise the soil and prevents erosion. Not to mention the positive impacts of these three habitats in terms of “production” and protection of biodiversity and fisheries resources.<sup>46</sup>

**Interview with Miquel RAFA,**  
*Fundacio Catalunya La Pedrera (Spain):*

Coastal wetlands are buffer zones to reduce erosion as well as the effects of storms, like the lagoons of the Ebro Delta.

**In addition, coastal ecosystems have a very high carbon sequestration rate,<sup>47</sup> a potential that is underestimated.** For example, mangroves play a crucial role in climate regulation by sequestering on average between 6 and 8 tonnes of CO<sub>2</sub>/ha per year.<sup>48</sup> In metropolitan France, wetlands are responsible for almost 0.2 million tonnes of CO<sub>2</sub> captured and sequestered each year.<sup>49</sup> Tidal marshes in the Netherlands have been estimated to have a sequestration rate of 60 000 t CO<sub>2</sub>/ha per year.

<sup>42</sup> Guide d'application: Les zones humides littorales – Des écosystèmes utiles pour le territoire, Novembre 2013, p. 15.

<sup>43</sup> Guide d'application: Les zones humides littorales – Des écosystèmes utiles pour le territoire, Novembre 2013, p. 15.

<sup>44</sup> Florent Givry et al., Etudes caribéennes, avril 2016, Les bénéfices de la protection des mangroves de l'outre-mer français par le Conservatoire du littoral : une évaluation économique à l'horizon 2040, p.13.

<sup>45</sup> BITOUN Rachel, 2017, Services écosystémiques d'un complexe Slikke-Schorre, p.44.

<sup>46</sup> Barbier et al., 2011- The value of estuarine and coastal ecosystem services, p.12.

<sup>47</sup> [https://www.iucn.org/sites/dev/files/import/downloads/mcifuentes\\_the\\_science\\_of\\_blue\\_carbon.pdf](https://www.iucn.org/sites/dev/files/import/downloads/mcifuentes_the_science_of_blue_carbon.pdf)

<sup>48</sup> Florent Givry et al., Etudes caribéennes, avril 2016, Les bénéfices de la protection des mangroves de l'outre-mer français par le Conservatoire du littoral : une évaluation économique à l'horizon 2040, p.14.

<sup>49</sup> Commissariat général au développement durable (2019). EFESE – La séquestration du carbone par les écosystèmes français. La Documentation Française (ed.). Collection Théma Analyse, e-publication, p. 32.



**Coastal ecosystems sometimes require restoration and conservation measures to boost their capacity to reduce the impacts of climate change, as well as their ability to withstand it.** For example, at the **Uitterkerkse Polder**, increasing water levels and converting arable land into grassland was necessary to maintain this natural buffer zone, which is also an important nesting site for birds. Similarly, in the Ebro Delta in Spain, hydrological and morphological restoration of coastal lagoons was carried out in concomitance with the conversion of former aquaculture and rice fields into coastal marshes. In the Tivat salt flats in Montenegro, stream regulation and ecological restoration of the salt flats' channels was implemented in order to improve the quality of the water. In Belgium, an ecological restoration of dunes has been undertaken, involving both the fixation of sand in places exposed to strong erosion as well as a management of these spaces with the removal of invasive species allowing a free evolution of the sand also.<sup>50</sup> In the Wadden Sea, through the **Natuurlijke Klimaatbuffers project**, several hectares salt marshes, seagrass beds and mudflats have been restored, which has resulted in reducing wave energy.

**The conservation of natural areas must be carried out on a larger scale, in particular through the transition from pilot sites to a wider application.** For example, the, **Natural Climate Buffers Coalition** – Netherlands brings together governmental and non-governmental organisations in a coalition to make the Netherlands resilient to the effects of climate change through using natural buffer zones. They are implementing different buffer zone solutions at more than 40 sites all over the country (carbon

sinks through marshes, ecosystem engineering to enhance sediment deposition or wave mitigation). This is also the case with the **ADAPTO** approach, implemented by the **Conservatoire du littoral** and the **Bureau of French Geological Survey (BRGM)** which is implementing flexible coastline management on 10 pilot sites, focusing on improving the resilience of coastal ecosystems, making it possible to develop knowledge on the role of natural environments in the organisation of the land-sea interface, as well as to support and evaluate adaptation solutions that can be shared at national and international level.

**Human uses on undeveloped coastal areas are changing and will have to adapt.** With sea level rise, the removal or relocation of certain coastal activities is necessary. For example, on the Brouage marsh site, the Conservatoire du littoral currently authorises agricultural grazing, but due to potential flooding of the site, it is considering alternative uses. Saltwater intrusion represents a major issue regarding agricultural land resulting in both soil and groundwater salinization.. In order to adapt to the problem of soil salinization, in the Netherlands, a **Twin Dike** pilot site of the **Interreg North Sea Region: Building with Nature** project has converted the land between two dykes into brackish soil and is experimenting with saline farming techniques on it.

These changes are occurring at the same time as the economy is evolving towards a less intensive agriculture, with sustainable tourism presenting new opportunities to better integrate adaptation to climate change in coastal areas.



<sup>50</sup> <https://dynamicdunescape.co.uk/>

## RECOMMENDATIONS :

### • Implement action plans to stop the loss of unbuilt areas and to reclassify built-up areas into natural areas

It is necessary to stop the loss of undeveloped areas, especially natural areas. In order to stop the loss of natural areas, legal mechanisms or land intervention should be implemented to regulate the loss due to anthropic pressure and encourage natural regeneration. This mechanism should also be combined with measures to prevent actions that could also contribute the loss of natural areas, such as construction of new buildings.

For example, the climate and resilience law in France has set a target of zero net artificialisation by 2050 with the aim of controlling land development.<sup>51</sup>

Protocol on ICZM for the Mediterranean invites countries to protect their coastal zones by establishing a setback zone where construction won't be allowed (Article 8). It invites countries to identify and delimit, outside protected areas, open areas in which urban development and other activities are restricted or, where necessary, prohibited. Protocol is promoting use of land policy instruments (Article 20) for implementation of measures and recommendations of this kind.

Although much of the coast is urbanised or developable, it is necessary to review the territorial planning in order to declassify areas that are not sustainable for coastal conservation and human safety reasons. An example of this is the Urban Master Plan for the review of unsustainable areas on the Girona coast in Catalonia approved in 2021, which has declassified 86 developable land and reduced 56 additional areas, avoiding the construction of more than 15,000 new homes in the Costa Brava.

### • Define and better understand the natural areas in coastal zones to be protected and restored to adapt and cope with the effects of climate change

The natural coastal areas to be restored must be identified on a European, national and regional scale. To this end, maps of the potential natural areas to be restored on a national, regional and local coastal scale can be produced.

For example, the Naturschutzbund Deutschland (NABU) has mapped the terrestrial natural areas suitable for restoration for Germany<sup>52</sup> and is currently developing a map of areas to renaturalise in the North Sea region as part of the WattRenature project. In England and Wales exist a mapping indicating potential restoration areas of salt marshes.

#### Interview with Lander WANTENS *Natuurpunt (Belgium):*

At the scale of the Flemish region a mapping of wetland loss and restoration potential against the perspective of their ecosystem services was conducted.

This development should also take into account the ecological, economic and sociological functions of the ecosystems and promote them for a better conservation of natural coastal areas.

The services provided by eco-systems should be listed and quantified, so to be fully recognised as important for the sustainable development of the coastal zone. In order to take into account all the eco-system benefits, it is important to engage with local communities and public decision makers and promote this multi-beneficiary approach.

<sup>51</sup> Loi n°2021-1104 du 22 août 2021 portant lutte contre le dérèglement climatique et renforcement de la résilience face à ses effets.

<sup>52</sup> <https://www.nabu.de/natur-und-landschaft/naturschutz/deutschland/29966.html>



**Interview with Aline KUEHL-STENZEL,**  
*Policy Officer Marine Conservation, NABU*  
*(Germany):*

WIN-WIN-WIN measures in natural areas should be promoted. The idea is that a conservation measure should, under ideal circumstances, allow for carbon capture, coastal protection and the maintenance of the biodiversity of the natural area at the same time.

• **Strengthen actions to restore terrestrial and marine coastal ecosystems**

Binding targets for ecosystem restoration, particularly considering adaptation to climate change in coastal areas, should be defined, beyond the framework of compensation measures.

These binding targets can notably be defined in the framework of the proposed EU nature restoration directive. This directive is part of the EU Biodiversity Strategy 2030 and aims to restore degraded ecosystems, particularly ecosystems with a potential for carbon capture and storage, to prevent and reduce the impact of natural disasters, and to improve knowledge and monitoring of ecosystems and their services.<sup>53</sup>

These measures must be accompanied by a reflection on the adaptation of protection measures for natural habitats, allowing them to be protected in a dynamic and not only static vision.

**Interview with Yves HENOQUE**  
*RAC/Plan Bleu and Fondation de France:*

The evolution of natural areas must be accompanied by measures to restore/preserve their natural state, but their possible evolution must be taken into account.

• **Anticipate and adapt human uses in natural coastal areas**

To anticipate and support the adaptation of human activities in coastal areas, there is a need to consider a regulatory framework that prioritises certain land uses accounting for the impacts of climate change. For example, for extensive agricultural uses in areas subject to future coastal change, consider setting up temporary land use agreements in view of the eventual relocation of activities further inland.

**Interview with Gwenal HERVOUET**  
*Conservatoire du littoral (France):*

The Conservatoire du littoral is proposing to farmers on land that will soon be submerged to relocate to Conservatoire land further back and is working with the Chamber of Agriculture to find other spaces if necessary.

Another option consists of adapting land use, such as through developing the blue economy and introducing new activities within those areas that will be affected by sea level rise.

**Interview with Yves HENOQUE**  
*RAC/Plan Bleu and Fondation de France*  
*(France):*

It is also possible to change human uses in coastal areas, for example with agricultural land that can be transformed into oyster farming, leisure activities, etc. It is not just necessary to move back but also to adapt one's activity.

<sup>53</sup> [https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030/eu-nature-restoration-targets\\_en#:~:text=The%20European%20Commission%20will%20put,the%20impacts%20of%20natural%20disasters.](https://ec.europa.eu/environment/strategy/biodiversity-strategy-2030/eu-nature-restoration-targets_en#:~:text=The%20European%20Commission%20will%20put,the%20impacts%20of%20natural%20disasters.)



## CHAPTER 3: TOOLS AND FINANCIAL MEANS FOR ADAPTATION IN COASTAL AREAS

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### INTRODUCTION:

Given the potentially profound changes required in coastal territories to adapt to the impacts of climate change, the implementation of adaptation measures requires substantial funding. Thus, the capacity of regional and local actors to deliver these measures is primarily dependent of financial aspects.

### CURRENT SITUATION AND DATA :

**The costs and damages related to climate change impacts in the coastal zone are high and will continue to rise.** Coastal flooding alone currently accounts for more than 1.4 billion euros of damage at the European level and, if no future investment in coastal adaptation is made, could increase exponentially to more than 210 billion euros by 2100.<sup>54</sup> As an example, a study has shown that the costs of marine submersion during the Xynthia storm on agricultural land in coastal areas were an estimated 500 euros per ha flooded in the first year following the storm.<sup>55</sup> Coastal retreat will also affect many property issues. A CEREMA study estimated that by 2100, between 5,000 and 50,000 homes in France could be affected by coastal retreat, with an estimated value between 0.8 and 8 billion euros.<sup>56</sup>

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<sup>54</sup> Michalis Voudoukas et al, Economic motivation for raising coastal flood defences in Europe, 2020.

<sup>55</sup> Durant et al, 2020, Impact of storm Xynthia in 2010 on coastal agricultural areas: the Saint Laurent de la Pré research team's experience.

<sup>56</sup> CEREMA, Evaluation des enjeux potentiellement atteints par le recul du trait de côte



**The costs of adaptation vary greatly depending on the choice of measures, with hard solutions particularly expensive.**

Although costs vary depending on local specificities, a study estimating the costs for various hard solutions assessed that building a rock fill dyke costs €1.8 million/km, - groins: €2,500 per linear metre (ml), - breakwaters: from €4,000/ml for an above-ground structure to €6,200/ml for a semi-submerged structure.<sup>57</sup> In comparison, even though the initial costs of Nature-based Solutions can be high, due to appraisals and monitoring requirements or land purchasing, in the long-term **the costs of Nature-based Solutions are lower than hard solutions.** For reference, the costs of certain necessary measures to accompany natural processes are estimated as follow: from 320 to 400 €/ml for the creation of a dune belt; 75 €/ml for the restoration of a dune belt; 75 €/ml for revegetation ; from 7 to 45 €/m<sup>3</sup> for beach nourishment (depending on the type of sediment (sand, pebbles), the volume nourished, the techniques used, etc.)<sup>58</sup> Thus, in the long-term, even if they can only be mobilised in certain specific cases, they have considerable economic advantages.<sup>59</sup> They also provide a number of co-benefits to an investment in the local economy, the creation of jobs that cannot be relocated, cost reduction, etc..

**There is a lack of an efficient economic valuation of coastal protection services provided by coastal ecosystems and habitats.** If some ecosystem services can be quantified in terms of their market value, most ecosystem services fall outside the realm of commercial production, e.g. coastal protection, erosion control, water purification or carbon sequestration.<sup>60</sup> Data on the cost effectiveness

of soft solutions or Nature-based solutions is missing. However, the economic benefits of nature-based solutions can be quantified. Economic values can be based on replacement costs or avoided costs and damages associated with inaction, delayed action or the failure of a “hard solution.”<sup>61</sup> One study estimated the coastal protection and stabilisation services of mangroves at €5,601/ha in Guyana compared to the costs associated with replacing them with artificial dykes.<sup>62</sup> One study estimated the protection services provided by eelgrass beds at the Baie de Beausais marine marsh site at €3,258/m/year.<sup>63</sup> In addition, the integration of vegetation in front of coastal defences can significantly reduce the costs of coastal protection against flooding while benefitting local biodiversity.<sup>64</sup>

**A large majority of public expenses regarding coastline management is dedicated to the improvement of sea defences.**<sup>65</sup> The cost-benefit analysis of these measures does not take into account the less costly alternatives of Nature-based Solutions as well as the economic benefits linked to the use of Nature-based Solutions (health of the populations, related trades, notably tourism activities, etc.). It is necessary to integrate these elements in the cost-benefit analysis of adaptation actions in order to allow a better involvement of this option.

It is also complicated to finance coastal adaptation actions depending on the region. For example, the overseas countries and territories are exposed to low co-financing capacities and few specific skills to mobilise. It is necessary to integrate these elements into the cost-benefit analysis in the context of a choice of adaptation

57 Les guides du CEPRI- Les collectivités territoriales face aux risques littoraux- Elaborer et mettre en œuvre une stratégie de réduction du risque de submersion marine, Août 2016, p.34.

58 Les guides du CEPRI- Les collectivités territoriales face aux risques littoraux- Elaborer et mettre en œuvre une stratégie de réduction du risque de submersion marine, Août 2016, p.38.

59 BIODIV'2050 – Evaluation socio-économique des Solutions fondées sur la Nature, 17 mai 2019, p.10.

60 Barbier et al., 2011, The value of estuarine and coastal ecosystem services, p. 5.

61 Plan Bleu, Rapport technique : Evaluation économique des services rendus par les zones humides méditerranéennes en termes de régulation du climat, p.50

62 Florent Givry et al., Etudes caribéennes, avril 2016, Les bénéfices de la protection des mangroves de l'outre-mer français par le Conservatoire du littoral : une évaluation économique à l'horizon 2040.

63 BITOUN Rachel, 2017, Services écosystémiques d'un complexe Slikke-Schorre, p.44.

64 Van Zelst et al., 2021, Cutting the costs of coastal protection by integrating vegetation in flood defences.

65 Rapport interministériel : Recomposition spatiale des territoires littoraux, mars 2019, Annexe I p.12.

action to be implemented in order to allow for a better understanding of the benefits and co-benefits of the different possible actions.

### Interview with Frank HOFFMANN *Natuurmonumenten (Netherlands):*

The cost-benefit analysis tool can be used in a more efficient way. For example, this tool should also take into account the loss of natural spaces in economic terms, for example the economic losses of fishing after the raising of a dike that separates a plain from direct access to the sea.

### Spatial relocation due to coastal retreat remains rare and costly.<sup>66</sup>

For example, a study estimated the cost of retreating to the sea at €85,000 per hectare for British projects carried out between 1990 and 2010.<sup>67</sup> The **SOLTER** project estimated several relocation projects in Languedoc-Roussillon for 30 individual houses at €22 million, on a 3 km stretch of coastline with 500 individual houses, 1,500 flats and 80 shops at nearly €835 million. Notably, the acquisition of property can be facilitated by the occurrence of natural disasters or extreme events, which can lead to a 10 to 25% reduction in the value of the property and accelerate its depreciation by reducing its residual lifespan.<sup>68</sup> This spatial recomposition can be financed in particular through compensation funds for relocation. For example, the Barnier Fund is a tool for the amicable acquisition or expropriation of property exposed to natural hazards, which has enabled the acquisition of more than 1,150 homes located in flooded areas for a total amount of nearly €300 million.<sup>69</sup> The existence of these funds does not always guarantee compensation for all coastal risks. In a number of European countries studied by a French interministerial report, there is no general compensation scheme for damage



due to natural erosion itself or for the purchase of threatened property. The coastal erosion is considered as a gradual natural phenomenon that does not have the character of an exceptional event like a natural disaster.<sup>70</sup> These funds also reflect social inequalities in their approach to compensation, with the Barnier Fund making a comparison between the cost of buying back property exposed to coastal risk and the cost of the protective measures needed to protect it, which favours higher value property.<sup>71</sup>

**Insurance has a crucial role to play.** According to the insurance company Swiss Re, climate change will lead to more frequent and severe

<sup>66</sup> Rapport interministériel : Recomposition spatiale des territoires littoraux, mars 2019, Annexe I p.12.

<sup>67</sup> Rapport interministériel : Recomposition spatiale des territoires littoraux, mars 2019, Annexe I p.13.

<sup>68</sup> Risks&Policy Analysts Ltd. Watsons, University of Newcastle, Change in asset values on eroding coasts, R&D technical report FD2623/TR, février 2009.

<sup>69</sup> Les guides du CEPRI- Les collectivités territoriales face aux risques littoraux- Elaborer et mettre en œuvre une stratégie de réduction du risque de submersion marine, Août 2016, p.50.

<sup>70</sup> Rapport interministériel : Recomposition spatiale des territoires littoraux, mars 2019, Annexe I p.1.

<sup>71</sup> Marie-Laure LAMBERT et al, Risques littoraux : à la recherche d'une « juste » indemnisation par le fonds Barnier- Réflexions à propos de la décision QPC n°2018-698 du 6 avril 2018, Syndicat secondaire Le Signal.





weather events that will rise global property insurance premiums to over \$183 billion.<sup>72</sup> Especially as sea level rise could lead to the retirement of insurance from assets in coastal areas for example as is happening for some properties in New Zealand.<sup>73</sup> Some insurance companies are beginning to develop economic risk assessment tools, such as **AXA's Coastal Risk Index**, which analyses coastal flooding risks by comparing scenarios with the integration of coastal ecosystems. **Axa Climate** proposes a comprehensive approach to secure nature-based projects in the face of climate change. They are assisting project developers in identifying key adaptation options to the main risks and increasing the long-term resilience and, on a cost-benefit analysis, prioritise adaptation measures, notably Nature-based Solutions quantifying the benefits brought for disaster risk reduction.

**In addition, the European Union offers diverse fundings for actions o research on adaptation**, through notably the LIFE+ fund, the ERDF funds for Interreg (inter-regional) projects, the Horizon 2020 fund, the BONUS fund and the EU Cohesion Fund. Among these funds, the LIFE Adaptation and Mitigation to Climate Change programme dedicates €905 million funds from 2021 to 2027 to adaptation to climate change.

#### **Interview with Régis LEYMARIE** *Conservatoire du littoral (France):*

European Union funds are a financial lever without which many adaptation projects could not be implemented.

As well as studies and definitive actions, European funding enables the recruitment of human resources. However, European funding remains one-off and it is necessary for project planning from the outset to ensure the sustainability of the adaptation project, including the need to fund post-implementation actions and evaluation of effectiveness in the long term.

#### **Interview with Adrien PRIVAT** *Conservatoire du littoral (France):*

The different phases of projects include a planning phase as well as the implementation of actions. However, the process from planning to implementation of specific adaptation actions takes more than 5 years and it is possible to find oneself in a situation where part of the funds are not used because the implementation deliverable cannot be completed due to the program period.

<sup>72</sup> <https://www.reinsurancene.ws/swiss-re-forecasts-rapid-property-market-growth-amid-shift-to-higher-risk-lines/>.

<sup>73</sup> Climate Sigma, 2020, Insurance Retreat- Sea level rise and the withdrawal of residential insurance in Aotearoa New Zealand.

**Interview with Birgit MATELSKI**  
*Coastal Protection and National Park Authority  
 of Schleswig-Holstein (Germany):*

European funding allows for administrative management funding rather than funding for operations in the field. It does rarely allow the financing of monitoring/capitalisation after the implementation of a project, and this also applies to the scientists who carry out this monitoring. They allow the recruitment of staff, but only for the project period. Other sources of funding must be mobilised to go beyond the project phase.

**Banks can also provide a significant source of funding.** Currently, it is estimated that private sector financing for adaptation to climate change represents less than 1% of climate financing.<sup>74</sup> Nevertheless, some institutions are beginning to engage in climate change adaptation financing, notably the World Bank, which has committed to providing direct financial support for adaptation measures on a global scale at \$50 billion over the period 2021-2025.<sup>75</sup> In addition, so-called “green bonds”, for green investments, make it possible to finance projects with a favourable impact on the environment or the climate.<sup>76</sup>

**Private companies and individuals also have a financial role to play in coastal adaptation to climate change.** However, companies and individuals are currently reluctant to invest in Nature-based Solutions, due to a lack of financial incentives and a lack of knowledge of the benefits that can accrue to them.<sup>77</sup> But there are examples, such as, *Natuurpunt* who has set up a *partnership with Pepsico* with significant funding to rehabilitate, among others, the Ultkerkse Polder to improve freshwater resources in order to avoid water salinization.

**Interview with Stefan VERSWEYVELD**  
*Natuurpunt (Belgium):*

It is especially important to demonstrate the socio-economic benefits in the actions for the company to finance such measures. Moreover, working with a company also allows us to value our work in the eyes of everyone.

Other examples of financial initiatives exist, such as the purchase of natural areas by private funds, such as the *Jensen Naturfond*, which financed the purchase of 611 ha of a polder in Denmark to renaturalise it and return it partially to the sea.<sup>78</sup> We can also mention the initiative of property owners in Northern Zealand setting up a sand embankment at a cost of €5.4 million, funded by a tax on properties located within 1 km of the sea, with a gradual tax rate according to their proximity with the sea.<sup>79</sup>

## RECOMMENDATIONS:

### • Generalise the financial evaluation of coastal ecosystem services as coastal protection mechanisms against the impacts of climate change

There is a need to quantify the value of coastal ecosystems as well as the oceans regarding coastal adaptation to climate change. The Overseas Countries and Territories are committed to identifying the economic value of the oceans as part of the development of a sustainable blue economy.<sup>80</sup> In this context, the Overseas association has drafted a **blue economy roadmap** to identify the potential of the island territories, for example coastal tourism.<sup>81</sup>

<sup>74</sup> Tuhkanen, Heidi; February 2020, Green bonds: a mechanism for bridging the adaptation gap, p.8.

<sup>75</sup> <https://www.banquemondiale.org/fr/news/feature/2019/03/07/this-is-what-its-all-about-building-resilience-and-adapting-to-climate-change-in-africa>

<sup>76</sup> Tuhkanen, Heidi; February 2020, Green bonds: a mechanism for bridging the adaptation gap, p.8.

<sup>77</sup> Sarabi et al., 2020, Uptake and implementation of Nature-Based Solutions: An analysis of barriers using Interpretative Structural Modeling, p.3.

<sup>78</sup> <https://www.avj.dk/avjnf/naturomraader/gyldensteen-strand/>

<sup>79</sup> [https://www.ecologic.eu/sites/default/files/publication/2013/2100-baltadapt\\_actionplan.pdf](https://www.ecologic.eu/sites/default/files/publication/2013/2100-baltadapt_actionplan.pdf)

<sup>80</sup> The Oceans Declaration of the Overseas Countries and Territories, p.3.

<sup>81</sup> OCTA, Blue Economy Roadmap, Realising the Potential of the Overseas Countries and Territories for Sustainable Blue Growth (Blue Economy).



- **Carry out a cost-benefit analysis of adaptation measures facing coastal risks integrating Nature-based solutions as well as socio-economic benefits and losses**

The scope of the cost-benefit analysis tool should be widened, to allow integration of Nature-based Solutions as well as socio-economic losses. Furthermore, the analysis should evaluate the costs of inaction and compare the different solutions that can be implemented such as hard, soft or Nature-based Solutions.

- **Promote the use of a multi-criteria analysis for adaptation actions in coastal areas**

A multi-criteria analysis complementary to a cost-benefit analysis is recommended for any public project implementing an adaptation action in coastal area. This enables for the examination of alternative projects taking into account elements that cannot be quantified or estimated such as equity, social acceptability, human well-being, vulnerabilities, the environment or landscape heritage.<sup>82</sup>

- **Strengthen the financing of adaptation actions with Nature-based Solutions on a national scale**

In the context of the French climate and resilience law, the by-law on the sustainable development of coastal areas has specified that in the context of the Real Lease for Adaptation to coastal erosion (BRAEC), which may be set up by municipalities in areas where the coastline is changing, the lessee will pay a price when the lease is signed, as well as a fee that will allow the financing of acquisition and renaturation operations over time.<sup>83</sup>

The State can also provide financial support for all integrated coastline management operations, including the implementation of Nature-based Solutions, as well as spatial recompositing that may include relocation of issues. Depending on the situation, various sources of funding

may be mobilised, including: programme 113 “Landscapes, water and biodiversity”, programme 135 “Urban planning, territories and housing improvement” (particularly for the implementation of urban planning operations within the framework of partnership development projects), the “coastline” envelope of the French infrastructure funding agency (AFITF), or funding from the Conservatoire de littoral or public land institutions. Work has also been initiated in the second half of 2022 to set up a fund to accelerate the ecological transition in the territories, which should include a section devoted to managing the coastline.

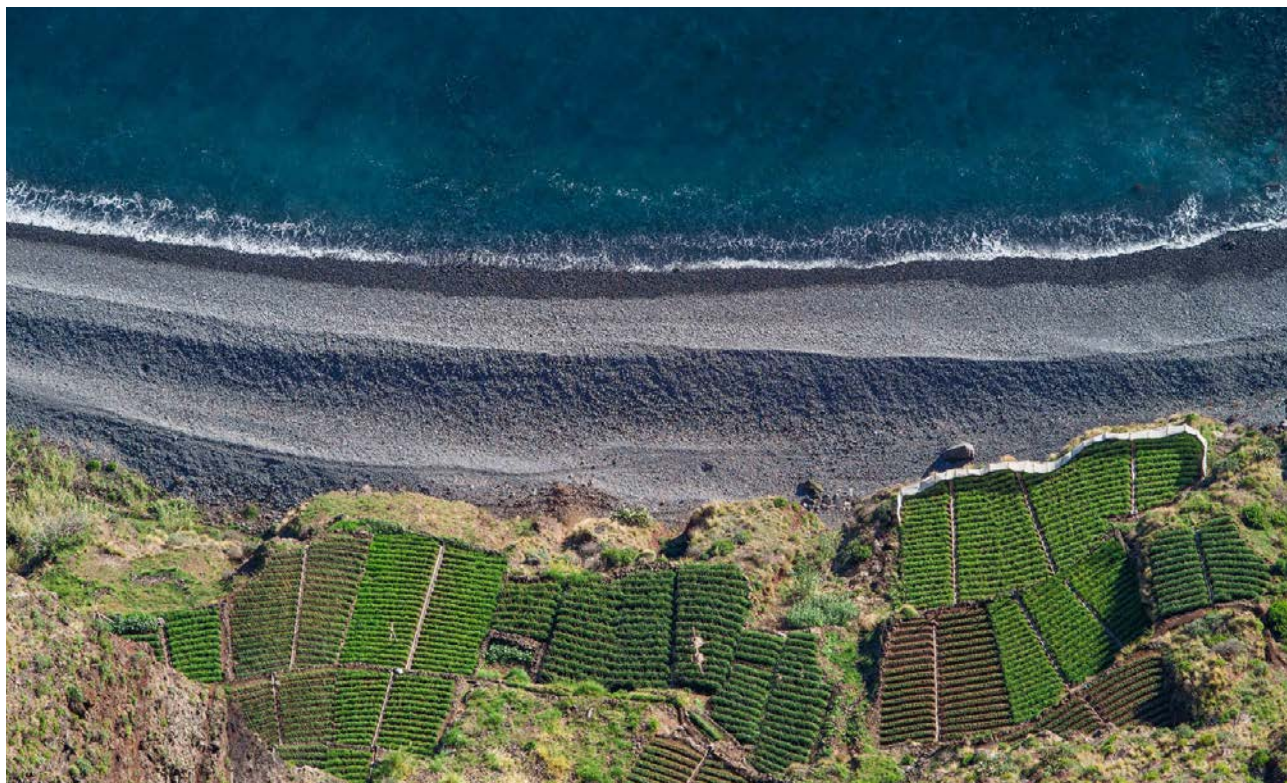
Private actors can also benefit from financial support, particularly within the framework of the Nature 2050 programme, launched in 2016 by the CDC Biodiversity and conducted in partnership with environmental associations, scientists and public actors. This programme is an innovative tool for financing the ecological transition of territories. It is supported by a dedicated endowment fund and aims to strengthen the adaptation of territories to climate change as well as to preserve and restore their biodiversity through the implementation of nature-based solutions by 2050. Its objective is to encourage economic actors to commit to action beyond their regulatory obligations, in a collective mobilisation approach. CDC is also working on the construction of a service offer for adaptation to climate change which will identify coastal areas as priorities.

- **Change the phasing or division of European credits**

To enable sustainable projects, division of funds would be a more suitable approach. This should consider phases of the project in order to have funding dedicated to the planning of adaptation action against climate change as well as conditional funding in a second phase dedicated to financing the implementation of adaptation actions. And a third phase for the monitoring and evaluation of actions.

<sup>82</sup> Inégalitto-Fondation de France-Conséquences des outils et politiques de gestion des risques littoraux en termes d'inégalités, 2020 LIEU-AMU-Marie-Laure LAMBERT, Elodie DOZE, Viktoriia SHIBEL, Clara MILLET-GUERIN, Clémence BAUDU, p.26-27.

<sup>83</sup> Ordonnance n° 2022-489 du 6 avril 2022 relative à l'aménagement durable des territoires littoraux exposés au recul du trait de côte.



Therefore, the phasing of European credits could be considered. Reflections should be led on promoting smaller and more adaptable projects with a risk analysis done progressively with requirements to pass from ratchets and move to a new phase.

**Interview with Janique ETIENNE**  
*French Facility for Global Environment, France:*

On specific projects, we integrate in the first phase of projects reflections for following phases and allow ourselves to follow up to as a demonstrator.

In addition, it could be useful to have financial guarantees from the European Union for the coastal territories to be able to have a long commitment and therefore a capacity to project themselves in successive stages. It is important to insist on the sustainability of funding to implement monitoring and a long term adaptive, dynamic approach.

• **Set-up financial incentives involving public authorities, banks, insurances to help enterprises and private landowners to adapt to climate change in areas at risk (flooding, inundation, etc...)**

Demonstrating that the implementation of certain adaptation solutions (including NbS) can reduce vulnerability based on a cost-benefit and multi-criteria analysis of measures to be implemented, insurances can encourage landowners to invest in adaptation solutions. Furthermore, financial incentives can be established to support sustainable development with mitigation objectives and reduction of coastal risks.<sup>84</sup> Financial initiatives should be addressed to residents as well as industries in order to facilitate the implementation of adaptation measures to avoid economic constraints, which is the main obstacle to implementation.<sup>85</sup> For example, the creation of carbon credit markets that allow local communities to benefit from blue carbon projects in coastal and marine ecosystems.<sup>86</sup> Regarding public fundings, reflections should be undertaken for the implementation of a coastal tax – or

<sup>84</sup> Bongarts Lebbe et al., Designing coastal adaptation strategies to tackle sea level rise, *Frontiers in Marine Science*, Frontiers Media, 2021, pp.740602, p.8.

<sup>85</sup> Laura Sinay, R.W. Carter, 2019, *Climate Change Adaptation Options for Coastal Communities and Local Governments*, p.5.

<sup>86</sup> <https://www.forest-trends.org/wp-content/uploads/2018/08/Q12018VoluntaryCarbon.pdf>



other similar financial mechanism- contributing to the overall adaptation of the coastal territory, defined at the relevant level regarding territorial solidarity. It is also possible to imagine a bonus-malus mechanism via a tax deduction for private landowners who implement adaptation measures within the framework of the coastal planning.

Regarding incentives led by banks, there should be consideration of the creation of a compensation bank funded by companies that need to implement compensation measures, such as for construction of harbours or major infrastructure, which could be used to fund a range of adaptation projects.







## **CHAPTER 4: DEVELOPMENT OF SCIENTIFIC KNOWLEDGE**

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### **INTRODUCTION:**

In order to adapt to climate change, it is necessary to have complete and precise scientific knowledge of the impacts on the coastal zone. Scientific data needs to be collected, analysed and finally used. Based on sea level rise over the last few decades and the evolution of the climate change, it is possible to plan regional and local projects that use these data to implement appropriate adaptation actions. This knowledge can be acquired through the observation of the coastline with the help of satellite tools, the collection of scientific field data and on-site observations of the impacts of global changes, notably climate change, as well as numerical models.

### **CURRENT SITUATION AND DATA :**

Coastal adaptation to climate change, needs a good scientific knowledge of both the effects of climate change on natural processes, and on the impact of the adaptation measures based on nature. Regarding the process of development of scientific knowledge, it is important to obtain the most essential and easily usable data for decision makers.

Sea level rise causes a multitude of impacts: increased flooding, erosion, salt intrusion leading to soil salinization, landward translation of the salt water wedge and scarcity of fresh water availability. Sea level rise scenarios based on scientific knowledge are mainly carried out at a global scale to regional scales (larger than 100 km) without taking into account the impact at the local scale, which can largely vary depending on the typology of the coastline. At regional scales, changes in sea level rise largely reflect changes in ocean density and circulation as well as



changes resulting from the contemporary mass redistribution related to ice sheets and glaciers<sup>87</sup> and from the glacial isostatic adjustment. At a local scale (less than 10 km), sea level rise is also altered by geomorphological and coastal processes.<sup>88</sup> There is a need for a fine-scale translation that enables the use of global data by local stakeholders.<sup>89</sup>

**Interview with Birgit MATELSKI**  
*LKN Schleswig-Holstein (Germany):*

We are conducting cooperation projects with universities to understand wave movements and sediment transport.

**A translation of scientific knowledge to a regional/local scale allows a better understanding of the issues.** In France, regional groups of experts on climate (GREC) have been created, such as **GREC-SUD**, which centralise, transcribe and share scientific knowledge in order to inform managers and public decision-makers so that the scientific results can be better understood and taken into account in developing policies. On a Mediterranean scale, the **MedECC** (Mediterranean Experts on Climate and environmental Change) is working on a scientific analysis of climate change and the environment for the Mediterranean basin. The **Copernicus Ocean State Report of 2021** indicates the differences of sea level rise between the Mediterranean, the Baltic, the Black and other Seas. In the UK, **UK Climate Projections** (the latest being UKCP18) have been developed and updated over the past 25 years to inform government policy, educate the public and provide guidance to businesses on how to manage the implications of climate change.

**There is also a need for regional/local scale observation of the coastline on other impacts.** For example, the coastal observatories in France, the **GIP littoral**, the **ROL Normandie** and in the England and Wales, the national network of the regional coastal observatories, such as **Southwest Coastal Monitoring** allow an effective observation of the coast, in particular the evolution of beaches and other habitats.

The participation of citizens in scientific fieldwork in the coastal zone also makes it possible to collect data on a more local scale.<sup>90</sup> Within the framework of the **AGEO Project**, subsidised by the **Atlantic Area Interreg fund**, one of the objectives is to launch several Citizen Observatories (Spain, Ireland, Portugal, France) around geohazard issues and to demonstrate the implication of these observatories in risk prevention. The **Observation Citoyen du littoral Morbihannais** or **BioLit** allow the involvement of citizens in the collection of field data, such as the monitoring of protective measures on the beach, measurements relating to the loss or gain of sand, the advance or retreat of dune vegetation, facilitate the collection of data so that they can be transmitted to scientists.

**The MPA-Engage project** aimed primarily to support Mediterranean MPAs to adapt to and mitigate the ongoing climate change effects. Through a participatory approach, MPA Engage monitored in a harmonized way the climate change impacts, elaborated vulnerability assessments and developed climate change adaptation action plans in 8 Marine Protected Areas located in 6 Mediterranean countries, namely Albania, Croatia, France, Greece, Italy, Spain.

87 Durand G, van den Broeke MR, Le Cozannet G, Edwards TL, Holland PR, Jourdain NC, Marzeion B, Mottram R, Nicholls RJ, Pattyn F, Paul F, Slangen ABA, Winkelmann R, Burgard C, van Calcar CJ, Barré J-B, Bataille A and Chapuis A (2022) Sea-Level Rise: From Global Perspectives to Local Services. *Front. Mar. Sci.* 8:709595. doi: 10.3389/fmars.2021.709595,p.4.

88 Woodworth PL, Melet A, Marcos M, Ray RD, Wöppelmann G, Sasaki YN, Cirano M, Hibbert A, Huthnance JM, Montserrat S, Merrifield MA, 2019: Forcing factors affecting sea level changes at the coast. *Surveys in Geophysics*, 40, 1351-1397, doi: 10.1007/s10712-019-09531-

89 Durand G, van den Broeke MR, Le Cozannet G, Edwards TL, Holland PR, Jourdain NC, Marzeion B, Mottram R, Nicholls RJ, Pattyn F, Paul F, Slangen ABA, Winkelmann R, Burgard C, van Calcar CJ, Barré J-B, Bataille A and Chapuis A (2022) Sea-Level Rise: From Global Perspectives to Local Services. *Front. Mar. Sci.* 8:709595. doi: 10.3389/fmars.2021.709595,p.6.

90 Centre Européen de Prévention des Risque d'Inondation, Rapport Panorama des outils de sensibilisation, Décembre 2020,p.29.

**Satellite observation of the coastline combined with in situ information and numerical models provides better information on sea level rise and its impacts, charting the evolution of sea level rise and enables to understand the decisive factors for sea level rise on a regional scale.**<sup>91</sup> It is essential and necessary to develop the tools to use these data. For example, the **Copernicus Land Monitoring Service** has developed a mapping tool to analyse **coastal changes between 2012-2018**. The **Copernicus Marine Service** implemented by Mercator Ocean International offers access to visual modelling tools for understanding the current state of sea level, indicators, reports and provides sea level and wave observations, forecasts and retrospective datasets covering the past decades. Some projects are already in place to use satellite data to estimate flood risks and to produce modelling tools for users containing maps and hydrological simulation models.<sup>92</sup> In relation to erosion, based on satellite data from the last 25 years using 15 coastal erosion indicators, the **ESA Coastal Erosion project** analysed the evolution of the coastline at local and wider scales and has enabled the development of operational coastal erosion monitoring services designed by and for end-users. However, there remains a lack of knowledge in some areas.

Specifically, there are knowledge gaps regarding certain coastal habitat typologies, as well as a lack of information on nearshore bathymetry or topography and their time evolution, despite them being key environmental parameters for coastal zones. This can result from the times that this information does not exist in certain countries including in Europe or the information is sometimes existing but not necessarily public. There is still a lack of knowledge about the process of soil salinization.

#### **Interview with Angélique MELET** *Mercator-Ocean International (France):*

More information on sea level rise at the coast and on the evolution of extreme water levels are needed.

In terms of adaptation measures, there is also a lack of scientific knowledge about Nature-based solutions, especially about the natural protection provided by the implementation of these solutions. Furthermore, their adaptability and their co-benefits they provide are not well known. This knowledge is important, notably to avoid maladaptation or structures with negative impacts on ecosystems.

#### **Interview with Frank HOFFMANN** *Natuurmonumenten (Netherlands):*

There is a lack of knowledge in ecological engineering, particularly on the solutions to be implemented and the application of these solutions in relation to the size, the evolution of the measures over time and their capacity to resist storm events occurring once every 100 years.

#### **Interview with Jonna VAN ULZEN,** *Rijkswaterstaat (Netherlands):*

Sand nourishment provides good coastal protection, but its impact on coastal ecosystems remains to be studied.

Some studies document the use of ecological engineering to implement coastal protection measures based on ecosystems, such as the use of oyster beds to protect subtidal areas from erosion.<sup>93</sup>

91 Melet A., C. Buontempo, M. Mattiuzzi, P. Salomon, P. Bahurel, G. Breyannis, S. Burgess, L. Crosnier, P-Y. Le Traon, L. Mentaschi, J. Nicolas, L. Solari, F. Vamborg, E. Voukouvalas, 2021. European Copernicus Services to inform on sea-level rise adaptation: current status and perspectives. *Frontiers in Marine Science*, 10.3389/fmars.2021.703425

92 <https://e-shape.eu/index.php/showcases/pilot5-2-satellite-earth-observation-derived-water-bodies-floodwater-record-over-europe>

93 Borsje, B.W., et al., How ecological engineering can serve in coastal protection. *Ecol. Eng.* (2010), doi:10.1016/j.ecoleng.2010.11.027,p.3.



### Interview with Arnault GRAVES *Conservatoire du littoral (France):*

We need more expertise on the notions of Nature-based Solutions and the demarcation from soft solutions.

Climate change is also leading to more frequent extreme storms<sup>94</sup>. Monitoring and forecasting of coastal flooding events, notably linked to sea level rise, is becoming more and more crucial.<sup>95</sup> The European Coastal Flood Awareness System **ECFAS** project aims to create a Europe-wide flood forecasting service with early warning of coastal flooding and management and recovery tools including post-storm impact assessment to enable effective restoration and preventive measures. Some tools also allow the modelling of storm and flooding events and their consequences on the coast, such as the **SURVEY** tool in the Pertuis Charentais in France.

In the UK a flood warning system already exists, which issues flood alerts and warnings to the



public, emergency organisations and business, to help people prepare for flooding and take action. This is based on monitoring rainfall, river levels and sea conditions.

### RECOMMENDATIONS:

- **Develop scientific knowledge on the impacts of climate change and on adaptation solutions at a regional and local scale**

There is a need to develop scientific knowledge at a local and regional scale to provide accurate information at an appropriate scale for coastal stakeholders to enable adaptation to the impacts of climate change. It is important that this is information on both the impacts of climate change as well as the adaptation solutions and is made accessible for decision-makers.

### Interview with Peter VAN BESIEEN *Afdeling Kust (Belgium):*

It is necessary to have sea level rise scenarios on a regional scale in order to allow local adaptation strategies.

- **Strengthen the collection and use of satellite, radar and in-situ data and to use different modelling tools for climate change evolutions based on historical evolutions in order to plan the adaptation actions to be undertaken**

There is a need to strengthen the collection and use of satellite, radar and in-situ data by decision-makers, including products derived from numerical modelling and indicators that include for accurate past and current information as well as projections of future evolutions.

<sup>94</sup> Oppenheimer, M., Glavovic, B., Hinkel, J., van de Wal, R. S. W., Magnan, A., Abd-Elgawad, A., et al. (2019). "Sea level rise and implications for low lying islands, coasts and communities," in *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*.

<sup>95</sup> Melet A., C. Buontempo, M. Mattiuzzi, P. Salomon, P. Bahurel, G. Breyannis, S. Burgess, L. Crosnier, P-Y. Le Traon, L. Mentaschi, J. Nicolas, L. Solari, F. Vamborg, E. Voukouvalas, 2021. European Copernicus Services to inform on sea-level rise adaptation: current status and perspectives. *Frontiers in Marine Science*, 10.3389/fmars.2021.703425

Despite the fact that they are uncertain, conceptual and physical modelling tools make it possible to visualise potential future changes, to conduct simulations and scenarios considering sea level rise as well as potential extreme events based on historical studies and to model the effects of different adaptation strategies. These modelling tools must make progress in taking into account geomorphological phenomena such as the effects of sedimentation and vegetation on foreshores or the adaptation of dune formations to changes in the coastline.

- **Develop coastal observation on a regional and local scale with the establishment of coastal observatories**

It is necessary to set up local in situ observatories of the coast using different tools of monitoring in order to collect precise field data to understand the evolution of the coastline. These observatories must also integrate socio-economic issues and more broadly the human sciences.

- **Set up sharing tools on a European scale allowing scientists and various climate and coastal adaptation experts to share their knowledge and expertise**

It is important to collect the various scientific publications and evolving knowledge on an adequate scale to allow for the broadest possible knowledge share of the impacts of climate change

and adaptation actions. In addition to this, it is important to coordinate the various initiatives to create a comprehensive database that enables better understanding by end-users.

The **CEREMA** has launched an **Expertise territoires** platform with the aim of providing an interface with a cross-cutting approach for coastal managers and decision-makers in the field to share and collaborate on their experiences and develop expertise in coastal adaptation approaches.

- **Develop the use of participatory science in the context of coastal area observation in order to involve civil society in the development of scientific knowledge**

The participation of the general public in scientific surveys of coastal observation can enable a considerable amount of data to be collected and used, and also develops a better understanding of the coastal change and its impacts by local communities. For society to be fully involved in the scientific knowledge, development there needs to be a change in the way that this is facilitated.





**Interview with Miquel RAFA**  
*Fundacio Catalunya la Pedrera (Spain):*

There is a need for a more robust scientific and technical basis to propose local solutions and mobilise society in the right way. For example, Catalonia has just created a *Centre for Climate Resilience in Catalonia*- a mix between a research institution and civil society organisations.

• **Make scientific data accessible to the widest possible audience for a better understanding of the effects of climate change in coastal areas**

Scientific data, climate change indicators and modelling tools should be centralised, readily accessible for scientists. After having analysed and translated this information into a comprehensible and relatable language, it should be shared with the wider public including wider society, specifically, public decision-makers and academics and the younger generations. This could strengthen the science-policy-society interface and the sharing of scientific knowledge on the effects of climate change and the potential impacts that may affect the citizens as well as contribute to an informed participation and facilitate the appreciation of risks and the appropriation of responses.

In addition, regarding future climate change scenarios, it will be necessary to relate the expected changes of temperature and sea level rise to the challenges and impact associated with these changes.

Finally, it is important to avoid miss use of scientific information through making any assumptions and limitations clear to users.

In France, the “Climate and Resilience” law of 21 August 2022 provides, for a set of exposed communes identified by decree, for the mapping of the evolution of the coastline in the short (0-30 years) and long (30-100 years) term. This mapping will form the basis for new measures targeting existing property in areas exposed to coastline retreat and authorised construction in the long-term exposed area. The inclusion of coastline recession exposure zones in urban planning documents helps to ensure that citizens are well informed.

At the same time, the law has extended the obligation to inform buyers and tenants (IAL) by sellers or lessors of property located in areas exposed to coastline recession and makes it compulsory to provide a risk report when the property is first visited. The advertisements for the sale of exposed properties must specify how to access this information.

• **Support the use of human sciences in the approaches for adaptation to climate change**

There is an obvious interest in the social sciences being better mobilised in public transition policies. Adaptation raises many questions as to the proper understanding of the socio-economic and political systems in place and their capacity to adapt to climate change. Research in the human and social sciences thus makes it possible to understand the functioning of existing measures and systems, by making the link with the socio-economic and political context on the one hand and climate change (new weather conditions, occurrence of extreme phenomena, etc.) on the other, in order to provide knowledge that complements scientific data.







## CHAPTER 5: INVOLVEMENT OF WIDER SOCIETY : APPROPRIATION AND SOCIAL ACCEPTABILITY

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### INTRODUCTION:

People living in coastal areas are increasingly exposed to the direct effects of climate change and evolving natural processes: sea level rise, coastal erosion, flooding. Moreover, with coastal change and the aspiration to create of resilient coastal areas, they must be able to express themselves in the framework of spatial planning, the implementation of adaptation measures as well as on landscape aspects.

### CURRENT SITUATION AND DATA :

Currently, the involvement of civil society in the decision-making process remains complex. **The tools for civil society consultation do not allow for full social appropriation of the subject of adaptation to climate change in coastal areas.** Today, citizens are taken into account in the decision-making process in an obligatory manner through various tools available to public decision-makers: consultations, public debates, public enquiries. Nevertheless, these tools do not reach most of the citizens concerned. It remains a challenge to identify all the stakeholders of the territory in order to implicate them properly and address the messages to the concerned population.



**The integration of wider society and all stakeholders in the spatial planning framework is important.** For example, the Flemish government has brought together local authorities, governmental and non-governmental organisations and representatives of wider society in the **Kust Visie** planning process to develop a long-term vision to develop the most socially desirable coastal zone planning and to protect the coastline against a 3-metre rise in sea level. In the Brouage marsh in Charente-Maritime (France), the **Conservatoire du littoral** is organising discussions with farmers regarding inundation of the site and to discuss what changes to land use would both improve the landscape character of the site and also to maintain agricultural activities on the marsh. A tidal parliament has also been set up on a larger scale, bringing together stakeholders on lands beyond the Conservatoire du littoral sites to reach a total surface of 15,000 ha. The **Environment Agency** (England) is conducting a study on joint working to address climate change adaptation in terms of flooding and coastline as part of its Flood and Coastal Erosion Risk Management Research Programme.<sup>96</sup> Another example, in Catalonia, the Baix Empordà maritime co-management board, a panel of agents from the Administration, the scientific community, the sectoral economy and wider society organisations have made commitments aimed at the compatibility of uses, the conservation and improvement of the natural heritage and the improvement of the environment of this natural protected area, including the avoidance of overfishing as a direct measure to guarantee the health and resilience of marine ecosystems.<sup>97</sup>

**The co-creation of coastal adaptation plans with all stakeholders is essential.** There is a need to demonstrate effective solutions using “**theory of change**” to effectively address the causes of climate change. In the framework of the Mediterranean Coastal and Adaptation Plans under the MedPartnership and MedProgramme,

the **RAC/Plan Bleu**, mobilised a participatory foresight method in Sibenik-Knin County in Croatia, the Kerkennah Archipelago in Tunisia, the Bay of Kotor in Montenegro and the Tangier-Tetouan-Al Hoceima Region in Morocco, **CLIMAGINE**, involving key stakeholders in the development of the plan: the decision-makers, researchers, representatives of civil society and key economic sectors. The Blue Plan is also mobilising the actors of the Agglomeration Community of Sophia-Antipolis on coastal adaptation through the **CASAdapt project**. Another example is the **CEREMA Boussole de la Résilience tool**, which provides a framework for reflection dedicated to any type of territory (town, inter-commune, district, department, region, watershed, natural park, coastal fringe, etc.) and any type of organisation (local authority, company, public body, association, etc.). It aims at strengthening resilience in order to better anticipate, act, bounce back, transform over time and, ultimately, reduce vulnerability.

#### Interview with Peter VAN BESSEN *Afdeling Kust (Belgium):*

Co-creation should allow the broadest possible measures to be defined by integrating citizens, authorities at different scales, scientific and environmental partners as well as partners economically involved in the coastal zone (tourism, port authorities, fisheries).

**The involvement of wider society and NGOs in the adaptation actions carried out is key for success.**

<sup>96</sup> Working together to adapt to a changing climate: flood and coast - Community engagement on climate adaptation- an evidence review, août 2019.

<sup>97</sup> Report ‘Un Litoral al Limit-Recomanacions per a una gestió integrada de la costa catalana, 2021, p.37.

### Interview with Aleksandra IVANOVIC *Morsko Dobro (Montenegro):*

In the framework of the management of Nature Reserve “Solila” in Tivat, we work with NGOs that are involved in birdwatching and conduct youth awareness site visits. The NGOs also act as a warning of the need for action, for example in relation to the erosion of the Ada Bojana beach.

**However, the acceptability of the measures by wider society is not fully achieved. The biggest problem remains the lack of basic knowledge about the causes, impacts, risks and solutions to climate change.** According to a survey in the UK, more than 85% of British people believe that climate change will not be visible for decades and a second survey indicated that 52% believe that climate change will have little or no impact on them.<sup>98</sup>

Above all, there is a lack of awareness of the risks they face and an inadequate risk culture among the coastal population, defined as the set of perceptions and behaviours adopted by a society in the face of risk.<sup>99</sup> This risk culture is characterised by a lack of memory of past disasters.<sup>100</sup>

**It is necessary to preserve the memory of past events to promote a risk culture.**<sup>101</sup> The social acceptance of adaptation measures is linked to the local situation as well as to the actions undertaken by the state and the storm events experienced. For example, in the archipelago of St-Pierre and Miquelon, after having experienced several floods, the implementation of a coastal

risk prevention plan with building restrictions has been well received by the inhabitants, who had integrated the vulnerability of the population and property. In terms of adaptation solutions proposed to the population, it appears that Nature-based Solutions have been the most preferred approach by the population. They are considering relocation for the village of Miquelon as well as the road to the Mirande pond.<sup>102</sup>

### Interview with Per SORENSEN *Danish Coastal Authority (Denmark):*

If the civil society living in a coastal area hasn't experienced a storm surge or natural disaster linked to climate change, they don't consider that there is an urgency or need to act in favour of adaptation to climate change in their coastal zone.

In the context of planning/implementing climate change adaptation measures, wider society is not also properly informed of the different existing adaptation measures, such as Nature-based Solutions or it can have a negative perception of them.<sup>103</sup> Questionnaires on communes that were exposed to the Xynthia storm showed that the public are more worried about the impact of any protection and prevention actions carried out on their daily lives than about the real risks of flooding or erosion.<sup>104</sup> This is also reflected in the lack of understanding of the adaptation solutions put in place.

**The tools for raising awareness and educating wider society and the various stakeholders allow for a better understanding of climate change in the coastal zone and the adaptation**

98 Lorenzoni, Nicholson-Cole, Whitmarsh, 2007. Barriers perceived to engaging with climate change among the UK public and their policy implications. *Global Environ. Change* 17 (3–4), p.447.

99 Gourgues, G., 2015, La culture du risque contre le territoire ? Les enseignements d'une recherche participative. In *Les risques naturels en zones côtières. Xynthia : enjeux politiques, questionnement juridiques*. Laronde-Clérac C., Mazeaud A. et Michelot A., Presses Universitaires de Rennes, Rennes, Coll. Univers des normes.

100 Blesius, Jean-Christophe Discours sur la culture du risque, entre approche négative et positive. *Vers une éducation aux risques ?*, 2013, p.3.

101 Beck, Elise, Approche multi-risques en milieu urbain. Le cas des risques sismique et technologiques dans l'agglomération de Mulhouse, *Géographie*. Université Louis Pasteur Strasbourg I, 2006. Français, p.5.

102 Philippenko, Xenia- L'acceptabilité sociale des solutions comme facteur de réalisation de l'adaptation: l'exemple d'un outre-mer, l'archipel de Saint-Pierre et Miquelon.

103 Sarabi et al., 2020, Uptake and implementation of Nature-Based Solutions :An analysis of barriers using Interpretive Structural Modeling, p.2.

104 Krien, Nathalie, Michèle-Guillou Elisabeth, Place des risques côtiers dans les représentations sociales du cadre de vie d'habitants de communes littorales, CIPS n°101 – 2014 – p.119.





**actions to be taken.** For example, simplified or explanatory tools on climate change aimed at public decision-makers and the public allow a better understanding of the issues at stake.

**Interview with Elodie DOZE**  
*Conservatoire du littoral (France):*

In the context of implementing adaptation actions of a technical nature, it is necessary to have non-technical summaries to help people understand the actions implemented.

For example, as part of the **Interreg Italy-Croatia -Adriadapt project**, explanatory leaflets have been produced for the mayors of coastal municipalities explaining the benefits of undeveloped natural areas in the face of climate change. **CEREMA** has developed “**Les petits essentiels**” leaflets for elected representatives of coastal municipalities to help them better understand climate change and the challenges of adapting coast and to facilitate coastal

planning. As part of the **ADAPTO** approach, **landscape videos of the historical evolution of the shoreline** also provide information on sedimentary dynamics and the modification of the area by man. In addition, the Brittany delegation of the Conservatoire du littoral has worked with students to develop educational tools for **landscape videos** that are shown to local elected officials who make decisions about land use planning with a view to spatial reorganisation of the area. Better than a technical speech, the sensitive approach through the landscape brings a more easily accessible and shared understanding of the phenomena. Other tools, such as the **LittoSIM** marine submersion simulations, help to raise awareness among coastal stakeholders about the risks of marine submersion.

Nevertheless, these awareness-raising tools must be part of a long-term approach. Currently, there is a lack of evaluation of awareness-raising actions and a lack of sustainability and animation

of the process.<sup>105</sup> Gathering feedback from users of a site that has experimented with adaptation can be a good initiative and contribute to raising the awareness of these stakeholders. For example, as part of the **ADAPTO** project, more than 1,678 questionnaires were carried out on 11 sites in order to gather the views of site users post implementation.

Furthermore, the exchange between stakeholders also helps understanding of all territorial issues. For example, within the framework of the **Sea'Ties** project supported by the **Ocean & Climate Platform**, **regional Sea'Ties workshops** conducted in the North Sea and Mediterranean regions, bringing together key stakeholders, have enabled them to exchange information on good practices and the challenges of sustainable adaptation of coastal cities in their territories.

Furthermore, elected representatives may encounter difficulties in getting wider society to fully adhere to the upstream phases of adaptation projects, as the social acceptability of measures is not always obvious. This can evolve thanks to communication with the general public, particularly in terms of territorial coordination and feedback. For example, the **Danish Coastal Authority** has identified 9 coastal habitat typologies and used these to show the public how different habitats naturally evolve, in order to demonstrate their importance and the benefits they bring.

**Interview with Régis LEYMARIE**  
*Conservatoire du littoral (France):*

In Normandy, for the past 15 to 20 years, the Regional Council has been leading a campaign on the theme of adaptation to climate change before moving on to the implementation of tangible actions.

Finally, the support of the local population for the adaptation actions carried out is essential.

**Interview with Aleksandra IVANOVIC**  
*Morsko Dobro (Montenegro):*

The support of local businesses for a project is very useful in order to value the adaptation work carried out.

**RECOMMENDATIONS:**

- **Strengthen the integration of wider society in the process of co-construction of spatial planning projects related to adaptation issues and in decision-making**

It is necessary to target civil society and all stakeholders that should be involved in the process of spatial planning projects for coastal adaptation to climate change at their territorial scale, in order to achieve the most socially acceptable and suitable development for all. Furthermore, it is important to involve the targeted stakeholders and to maintain public awareness as implementation of adaptation measures to have their long-term support.

- **Strengthen competences and awareness of the population in order to have a sufficient degree of awareness and knowledge of the past situation and the current state and dynamics of the coastline**

Communities have the legitimacy to decide for themselves. Education and awareness-raising of the population at all ages must be sustained in order to enable wider society to be in possession of scientific knowledge about changes in the coast in response to climate change.

Beginning with an explanation of past coastal movements, which are often spectacular, allows knowledge to be based on indisputable facts that allow a better understanding of the current situation and possible future developments.

Educational actions must also be specifically developed for schoolchildren, the citizens of

<sup>105</sup> Centre Européen de Prévention du Risque d'Inondation- Rapport-Panorama des outils de sensibilisation, décembre 2020, p.36.



tomorrow, so that the issue of coastal protection is addressed from an early age. Such actions have been carried out within the framework of the ADAPTO project: the Conservatoire du Littoral has collaborated with the “Centres Permanents d’Initiatives pour l’Environnement” and their National Union (organisations approved by the Ministry of Education) to develop teaching aids that can be used in coastal communities.

• **Disseminate information on the risks related to climate change to which the local population is exposed at different scales notably through public decision-makers**

Decision-makers should inform the general public about the climate change risks they are, or will be, exposed to so that they have all the necessary information to make sensible decisions. For example, it is necessary to inform buyers of real estate in coastal areas of the environmental risks they are, or will be, exposed to. Finally, it is crucial to keep memories alive of the past events experienced in the coastal area to remind the local population of its vulnerability to coastal risks by keeping the risk culture alive.

• **Popularise scientific information on adaptation to climate change and conduct a territorial animation with awareness-raising workshops coupled with field trips in order to show wider society the adaptation measures undertaken**

There is a need to more widely share information on climate change adaptation techniques in the coastal zone and to explain the ecosystem values of coastal habitats in order to achieve a better understanding by the general public and a better social acceptance of these measures.

Public decision-makers should organise workshops and various forms of engagement activities aimed at the general public in order to demonstrate the adaptation measures they intend to undertake. Appropriate communication tools and approaches, such as 3D modelling, drawings and landscape approach in order to develop a good understanding of the civil society. Sharing of any of any animations should also be considered at a European and Mediterranean scale, in particular by promoting the establishment of local ambassadors.







## CHAPTER 6:

# CAPITALIZATION AND COOPERATION BETWEEN COASTAL STAKEHOLDERS AT A EUROPEAN AND INTERNATIONAL SCALE

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### INTRODUCTION:

All the coastal zones of the European Union (EU) Member States and the countries of the Mediterranean basin are threatened by climate change. Public and private organisations in the coastal zone are implementing adaptation actions, but sometimes lack the time and means to learn about the policies and actions implemented in neighbouring countries or to benefit from their feedback. It is more necessary than ever to share knowledge, strategies, approaches and tools in order to promote and strengthen our respective experiences and know-how, specifically through formal or informal collaboration on a European and international scale.

### CURRENT SITUATION AND DATA :

There are several networks or exchange platforms working entirely or partly in the coastal zone, notably on the different visions/strategies for adapting to climate change at different scales: international, European, and even regional level.

On a European scale, the **Conference of Peripheral Maritime Regions (CPMR)** represents the public decision-makers of more than 150 coastal regions of the 24 EU Member States and is committed to promoting the interests of maritime regions with political institutions, particularly with regard to the development of regional climate change adaptation strategies. The Overseas Territories and Countries Association (OCTA) brings together the governments of the 13 Overseas Countries and Territories of the European Union and serves as a platform to achieve common goals such as sustainable



development of the OCTs, territories representing a multitude of financial opportunities, notably regarding the development of Blue Economy. The **Coastal & Marine Union (EUCC)** also serves as a bridge between scientists, environmentalists and public decision-makers to promote sustainable coastal development, including the conservation of coastal areas. Bringing together experts from coastal Member States in the form of an international branch and local branches (France, Germany, Poland, Netherlands), EUCC develops exchange actions according to funds mobilised. Bringing together site managers, researchers, ecologists, national policy makers and coastal engineers, the **Beach and Dune Network** aims to conserve coastal dunes by supporting the development of knowledge to develop sustainable use and management of these areas. Bringing together European nature conservation managers, the **Eurosite** network enables the exchange of knowledge, notably through a study group on wetlands and climate change, exchanging adaptation and mitigation solutions based on an ecosystem approach and sharing information and international initiatives on the subject. On an international scale, the **International Land Conservation Network** also supports land trusts and private conservation organisations promoting climate change solutions. Other informal networks also exist, notably the **North Sea Coastal Manager Group**, which brings together public coastal management agencies from countries bordering the North Sea (Denmark, Germany, UK, the Netherlands, Belgium, France), allowing exchanges between managers as well as the setting up of joint projects. The Conservatoire du Littoral itself leads a network of **European and Mediterranean Coastal Agencies (EMCA)**, which brings together public and private organisations in Europe and the Mediterranean that play a key role in coastal conservation and management issues at regional and national levels. The aim is to strengthen the links between these agencies, to share their respective visions and to work together on the challenges of adaptation to climate change.

**The digital platforms allow for an exchange of experiences on coastal adaptation solutions implemented in the face of climate change as well as a knowledge sharing to meet the needs of decision-makers at the local level.** The Ocean & Climate Platform, whose objective is to improve understanding of ocean-climate interactions, has launched the international Sea'ties initiative, mobilising elected representatives, scientists, etc. in collective reflexion to overcome common challenges and the exchange of practices & knowledge. Notably through (1) regional workshops, (2) by making available to elected officials, managers and other stakeholders involved in the transition a Solutions Map listing adaptation initiatives deployed in coastal cities and territories in response to sea level rise. 3) This work informs the production of regional recommendations and international advocacy. 4) In February 2022, together with over 40 mayors and governors of coastal cities, it has launched the Sea'Ties Declaration calling for a greater involvement of the international community to support the adaptation of coastal cities and territories to sea level rise.

Other platforms also serve as a guide for the implementation of climate change adaptation actions.

On a European scale, the Climate-ADAPT Platform, in partnership with the European Commission and the European Environment Agency, aims to support Europe in adapting to climate change. Among other things, the platform provides access to and shares information with users on climate change. Still at the European scale, the European MSP Platform, service of the European Commission for Member States and other stakeholders, aims to share relevant knowledge and experiences on Integrated Coastal Zone Management, Marine Spatial Planning, and coastal adaptation. This platform acts as the central exchange forum for the rich knowledge generated in past, current and upcoming MSP processes and projects (practical experiences, information on training programs and workshops, ...).

On a regional scale in the Adriatic Sea, the Adriadapt Platform is dedicated to the exchange of information to strengthen the resilience of local communities on the Adriatic coast to climate change, through tools such as guides dedicated on coastal resilience.

#### Interview with Daria POVH PAP/RAC (Croatia):

Integrated coastal zone management (ICZM) has been implemented in Mediterranean for over 3 decades. The advantage of ICZM systemic approach is that it seeks for policy solutions to environmental and policy challenges in an integrated manner, meaning that no solution should create another problem and that every solution should tackle more than one issue. Systemic approach is the only one that could enable us to improve coastal resilience, since coastal adaptation without mitigation won't succeed.

Within the framework of the **REST COAST** project, which aims to improve practices and techniques used in restoration of coastal ecosystems, generate new tools and data to analyse risk reduction in the face of the effects of climate change, and enable the creation of innovative financing, a platform should provide the tools necessary for the restoration of coastal ecosystems. Another EU-funded project, **CoCliCo**, coordinated by the BRGM, is developing a platform for decision support on coastal risks and adaptation for local decision-making contexts. It will explore key risk factors by adapting visualisation and analysis techniques to the local scale by combining relevant and high quality geo-spatial information layers. The **Knowledge Hub on Sea Level Rise** focuses on sea level change from regional to local scale and should enable interaction between research and regulators to exchange scientific and socio-economic developments.

**Exchanges of experience and know-how on a European and international scale are beneficial for a better understanding of adaptation to climate change in the coastal zone. In particular, they allow for the sharing of good practices as well as learning from mistakes that may have occurred in the implementation of solutions.** Numerous cooperation projects exist at different scales addressing climate change adaptation in the coastal zone. On a European scale of more than 5 countries and over 1000km of coastline, the **Coastal Erosion project** is developing operational tools for coastal erosion monitoring for end-users in Europe. Many European cooperation projects (LIFE or INTERREG) exist on a cross-border or regional scale dealing with adaptation to climate change:

- The **MAREGOT** project between France and Italy, on coastal erosion risk management and cross-border governance actions.
- The **LIFE+ Nature FLANDER** project, on the cross-border restoration of dunes between France and Belgium.
- The **PACCO** project, a cross-border project between France and England, on the promotion of adaptation to coastal change.
- The **Adriadapt** and **ADRIACLIM** projects, between Italy and Croatia, the latter aiming at developing regional and local adaptation plans based on meteorological and oceanographic information using new modelling systems.

On a regional scale, the **SARCC** (Sustainable Coastal Cities and Resiliencies) project aims to expand the use of Nature-based Solutions in coastal management and policy-making between countries bordering Channel and North Sea. In the North Sea region, several cooperation projects are carried out on the theme of adaptation to climate change in the coastal zone, such as Interreg North Sea Region: Building with Nature developing knowledge on SFN as a solution to flooding, especially marine flooding, through pilot sites to stimulate the application of the concept by European governments or **C5a**, an approach to flood risk management from clouds to coast taking into account the results of 7 ongoing Interreg projects.



In terms of scientific cooperation projects, the **PROTECT** project aims to assess and project sea level rise on a global, regional and local scale based on quantified uncertainties. Bringing together scientists working on sea level and other stakeholders ranging from glacier experts to coastal impact specialists, the project seeks to identify important risks and opportunities from global to local scales.

**Interview with Birgit Matelski**  
*Coastal Protection and National Park Authority  
Schleswig-Holstein (Germany):*

The cooperation projects supports the comprehension of the different visions of the states on the adaptation of the coast to climate change and to know the results of the different projects as well as to have contact persons in the different countries in case of demand on the actions undertaken. However, the projects are not always adapted to the needs of the different participating organisations, especially with the diverging visions of each country. But of course the exchange expands our view.

**Interview with Stefan Verweyveld**  
*Natuupunt (Belgium):*

Interreg cooperation projects are often carried out between neighbouring countries in the same region, e.g. the North Sea region. However, it would also be beneficial to develop cooperation projects on the scale of all European coastal areas. The climate change problems we face are the same and we can learn a lot from each of the different coastal regions.

## RECOMMENDATIONS :

- **Strengthen cooperation between countries on a European or international scale within the same maritime façade or region (Atlantic, North Sea, Mediterranean Basin, Overseas territories) and join existing networks of coastal managers in order to cooperate with stakeholders on a similar scale on the subject of adaptation to climate change**

It is important to strengthen cooperation between countries having similar coastal habitats and issues, as well as on an international scale in relation to coastline management and adaptation to climate change to have a better overview of the different actions that are being implemented. Joining a network allows an exchange of experiences or learning from local stakeholders who have already succeeded in adapting their coast to climate change.

- **Use and support existing formal and informal networks and exchange platforms at European, international and regional level with the objective to achieve better adaptation to climate change**

There are many tools on the exchange platforms based on different types of habitat and coastal areas that already allow for effective coastal adaptation to climate change. It is important to be aware of these tools and to reflect based on them on the potential adaptation actions to be implemented

There is a need to highlight existing tools and give visibility to existing structures through enhanced communication, particularly by public decision-makers. Regarding international engagements, notably in the framework of the COP, coastal issues should be better identified and integrated in the countries resolutions.

- **Design cooperation projects at European, Mediterranean level, taking into account the specificities of the different States in order to allow for better adaptation to climate change on a case by case basis**

When setting up cooperation projects on a European and Mediterranean scale, in particular through European funds, it is also necessary to take into account the different specificities of each territory of the participating states in order to address their problems in the best way.

- **Continue to develop exchanges of experience and know-how between coastal stakeholders at European and international level and promote the creation of new coastal networks allowing better cooperation between stakeholders for learning and sharing of experience on the different topics of adaptation to climate change**

In order to improve knowledge sharing and the exchange of good practices regarding adaptation of coastal zones to climate change, it is necessary to reflect on the need to create new networks and on the scale of group of individuals that should be created.

#### **Example - Initiate the creation of a European Association of Coastal Elected Officials:**

Proposed in the Pornic Appeal by the French National Association of Coastal Elected Officials in 2021, the objective is to share experiences between coastal elected officials on a European scale and facilitate supranational actions with the creation of a European Association of Coastal Elected Officials.<sup>106</sup>

#### **Interview with Aleksandra Ivanovic, Morsko Dobro (Montenegro):**

It is necessary to develop a platform for the exchange of scientific knowledge on natural coastal processes in order to better understand the impacts of climate change at our scale.

#### **Interview with Adrien PRIVAT Conservatoire du littoral (France) :**

The development of a network dedicated to feedback from sites on a continental scale would make it possible to be informed about actions implemented that have worked or failed.



<sup>106</sup> <http://anel.asso.fr/wp-content/uploads/2016/05/DOSSIER-DE-PRESSE-APPEL-DE-PORNIC.pdf>



## ORGANISATIONS AND INITIATIVES ENDORSING THE CONCLUSIONS OF THE POLICY PAPER

### Europe & International



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Environmental Protection  
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Axa Climate



Lincoln Institute of Land Policy



International Land Conservation  
Network (United-States)



Mercator Ocean International



SEA-TIES project - adaptation of  
coastal cities to sea level rise



Interreg France (Channel) England project  
«PACCo - Promoting Adaptation to Changing Coast»

#### Albania



Agjencia Kombëtare e Bregdetit  
National Coastline Agency

#### Algeria



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#### Germany



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#### Belgium



Natuurpunt



Agentschap voor Natuur en Bos  
(Nature and Forest Agency)



Agentschap Maritieme  
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#### Spain



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#### France



Tour du Valat



Géosciences pour une Terre durable  
bregm

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#### Italy



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#### Montenegro



Javno preduzeće za upravljanje  
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management of Montenegro)

#### Poland



Society  
for the Coast

#### Netherlands



Rijkswaterstaat  
Directorate-General  
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Aktis Hydraulics



Natuurmonumenten



Environment Agency  
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