Restoring Coastal Wetlands in Europe

Implementation Roadmap to Guide National Action

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Executive Summary

Planning the restoration of coastal wetland habitats is a key element for National Restoration Plans under the EU Nature Restoration Regulation, national commitments under the Ramsar Convention as well as reporting requirements on wetlands emissions and removals under the EU Regulation on Land Use, Land Use Change and Forestry.

This report presents an implementation roadmap which aims to assist national authorities and stakeholders in developing a national strategy or roadmap for coastal wetland restoration. It presents general principles and guidance which can be used by any EU country to prepare its own restoration strategy or roadmap. More specifically, the roadmap gives insights and guidance on how to use the tools and results of the EU-funded project RESTORE4Cs in planning coastal wetland restoration and in defining priorities to contribute to the achievement of key policy targets for climate and biodiversity.

The roadmap is structured as a strategic framework with focus on actions and coordination pathways at national level, which are crucial to guide more detailed planning of restoration actions at site-level. It outlines the main elements that national authorities and other stakeholders may include in a national strategy or roadmap for coastal wetland restoration. The application of the relevant RESTORE4Cs tools can help progress coastal wetland restoration for climate change mitigation and other co-benefits, based on the latest available EU data and state-of-the-art methods for assessing wetland conditions and planning restoration actions.

The implementation roadmap follows a decision-making logic in a stepwise approach, starting with a baseline assessment of coastal wetlands and relevant policies at national level, moving to the operationalisation of relevant policy targets with appropriate indicators, prioritisation of coastal wetlands for restoration, and then proceeding to planning suitable restoration actions at the site level. In three cross-cutting thematic blocks, the roadmap underlines the importance of enhancing the integration of coastal wetland restoration in policies on nature and biodiversity, climate mitigation and adaptation and other relevant fields; good governance structure, stakeholder participation and public-private partnerships to support coastal wetland restoration; and enabling capacities and increasing public awareness on the value of restored coastal wetlands.

About the project

RESTORE4Cs (Modelling **RESTOR**ation of w**E**tlands for **C**arbon pathways, **C**limate **C**hange mitigation and adaptation, ecosystem services, and biodiversity, **C**o-benefits) is a Horizon Europe project led by the University of Aveiro, which evaluated the effect of restoration actions on wetlands´ ability to mitigate climate change and provide various ecosystem services. Its mission is to support the implementation of EU climate and biodiversity policies, by:

- gathering effectiveness data on restoration and land use management actions;
- structuring a European Community of Practice;
- upscaling models and integrative assessment tools;
- designing a multi-actor approach for stakeholder engagement.

RESTORE4Cs identified six Case Pilots for its activities. These comprise coastal wetland ecosystems in different states of preservation, with various alterations, and offering a range of restoration measure types already in place.

The six Case Pilot sites provide a good geographical representation within Europe and its biogeographical regions: Mediterranean (Valencian Wetlands in Spain and Camargue in France), Atlantic (Ria de Aveiro in Portugal and South-West Dutch Delta in the Netherlands), Baltic (Curonian Lagoon in Lithuania) and the Black Sea (Danube Delta in Romania).

Project´s results are available through a digital platform serving as a Decision Support System (DSS) for stakeholders and wetland practitioners and providing more reliable information to drive and prioritise wetlands restoration actions.

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List of Abbreviations

ACC	Abatement Cost Curve
CAP	Common Agricultural Policy
CBA	Cost-Benefit Analysis
CH_4	Methane
CLC	CORINE Land Cover
CO_2	Carbon Dioxide
CORINE	Coordination of Information on the Environment
CPIE	France´s Permanent Centre for Environmental Initiatives
CRCF Regulation	Carbon Removal and Carbon Farming Regulation
CSR	Corporate Social Responsibility
DEM	Digital Elevation Model
DRF	Drought Events Frequency
EC	European Commission
ECoP	European Community of Practice
ESG	Environmental, Social, Governance factors
EU	European Union
FRMP	Flood Risk Management Plan
GAEC	Good Agricultural and Environmental Conditions
GHG	Greenhouse Gas
GIS	Geographic Information System
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
LULC	Land-Use/Land-Cover
LULUCF	Land Use, Land-Use Change and Forestry
MAES	Mapping and Assessment of Ecosystems and their Services
MAVT	Meta-Analytic Value Transfer
MCA	Multi-Criteria Analysis
MSFD	Marine Strategy Framework Directive
N_2O	Nitrous Oxide

NbS	Nature-based Solutions
NDVI	Normalised Difference Vegetation Index
NECP	National Energy and Climate Plans
NGO	Non-Governmental Organisation
NRR	Nature Restoration Regulation
PES	Payment for Ecosystem Services
POCs	Portugal´s Coastal Management Programmes
PPP	Public-Private Partnership
PRW	Potentially Restorable Wetlands
PWA	Potential Wetland Areas
RBMP	River Basin Management Plan
RVO	Netherlands Enterprise Agency
SEEA EA	System of Environmental-Economic Accounting, Ecosystem Accounting
SNPN	France´s National Society for Nature Protection
UAA	Utilised Agricultural Area
UNEA	United Nations Environment Assembly
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
WEI	Water Exploitation Index
WFD	Water Framework Directive
WP	Work Package

Glossary

Active restoration	Process that eliminates the source of degradation and disturbance of an ecosystem and implements measures to accelerate its recovery and overcome obstacles to that recovery.
Coastal wetlands	Coastal wetlands are areas along coastlines that are temporarily or permanently flooded by salt, brackish or fresh water. These ecosystems are characterised by phreatophylic and submerged vegetation. According to the Ramsar Convention, coastal wetlands include "water that is static or flowing, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six meters"[1]. European coastal wetlands include seagrass, tidal and freshwater marshes as well as tidal and non-tidal flats and creeks. These habitats can be found in coastal lagoons, estuaries, and other transitional waters, as well as in fjords, sea lochs, and embayments[2]. This harmonised definition of coastal wetlands was developed based on the work conducted in the RESTORE4Cs Horizon Europe project. It is aligned with the Ramsar Convention and captures the full land-sea-continuum.
Index	An index is a composite measure that combines multiple variables to provide a comprehensive overview of a specific issue or performance area. Indexes are often used to simplify complex data sets and present a broad picture of trends and changes over time. An example of an index could be the Coastal Wetland Health Condition Index, which might include indicators related to water quality, biodiversity, and habitat extent.
Metric	A metric is a quantifiable measure used to track and assess the status of a specific process or activity. Metrics are usually more granular and detailed than indicators and can be used to support the calculation of indicators and indexes. For example, a metric for coastal wetland health might be the number of bird species observed in a wetland area or the concentration of pollutants in wetland water.
Nature-based solution	Nature-based solutions are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits[3].
Passive restoration	Process that eliminates the factors of degradation and disturbance and permits the natural regeneration of the ecosystem.

1 Ramsar Convention. (1971). *Convention on Wetlands of International Importance especially as Waterfowl Habitat*. Ramsar Secretariat. Ramsar, Iran. Available at: https://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf.

2 Otero, M. et al. (2024). *How can coastal wetlands help achieve EU climate goals?* Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

3 United Nations Environment Assembly (UNEA). (2022). *Nature-based solutions for supporting sustainable development.* United Nations Environment Resolution UNEP/EA.5/Res.5. Available at: https://wedocs.unep.org/rest/api/core/bitstreams/4caa2911-37ea-4915-b378-d2c2d525ee35/content.

Policy indicator	A policy indicator is a specific, measurable element used to assess and track progress towards achieving policy goals and objectives, focusing on inputs, output and outcome measures. These indicators are designed to provide timely, relevant information that informs decision-makers about the effectiveness of policies. They are based on criteria that aim to capture the relevance for the targeted (policy) questions by providing timely, relevant information on the coastal wetlands and data characteristics, which require spatially explicit and quantity-specific data and metrics, e.g. descriptive statistics, coverage, type, scale and/or year. For example, a policy indicator for coastal wetland restoration might be the percentage increase in restored wetland areas.
Stakeholder	Any group or individual who can affect or is affected by wetland management.
Wetland management	Refers to the policies, practices and actions taken to maintain or restore the natural state and functions of wetland ecosystems. This involves a balance between the conservation of wetlands for their ecological benefits and the sustainable use of these areas for human needs. The goal is to ensure that wetlands continue to provide their essential services to humans and nature. Effective wetlands management strategies may include protecting wetlands from anthropogenic threats, regulating water levels to mimic natural cycles and prevent degradation, restoring wetland habitats that have been lost, damaged or degraded, implementing policies that encourage sustainable use and conservation efforts.
Wetland restoration	A key aspect of wetlands management is the restoration of lost or altered wetlands. This process often involves re-establishing the natural water flow, removing pollutants, replanting native vegetation or re-creating lost wetland habitats. Restoration projects have been shown to not only bring back lost wetland functions but also to enhance resilience against climate change impacts. Successful wetland restoration efforts can also lead to significant environmental and social benefits.

01

Introduction

1.1 An implementation roadmap – What for?

Europe's coastal wetlands are critical ecosystems which can play a crucial role in climate change mitigation and adaptation[4]. When restored, they act as nature-based solutions (NbS) reducing greenhouse gas emissions (GHG), removing CO_2 from the atmosphere[5], and acting as natural sponges in the landscape that buffer the impacts of both floods and droughts. However, most coastal wetland habitats in the European Union (EU) are either in poor ecological status or we lack sufficient information to assess their status. These ecosystems face multiple pressures associated to land-use transformations, sea level rise, droughts, eutrophication, invasive species, emerging pollutants and the expansion of economic activities.

Since 2023, the EU-funded project RESTORE4Cs worked on the evaluation of the effects of restoration actions on coastal wetlands' ability to mitigate climate change and on the development of methods and tools to support decision-making on coastal wetland restoration.

The planning of coastal wetland restoration is a key pillar for National Restoration Plans which have to be developed by EU Member States in 2026 under the EU Nature Restoration Regulation (NRR), national commitments under the Ramsar Convention as well as reporting requirements on wetland emissions and removals under the EU Regulation on Land Use, Land Use Change and Forestry (LULUCF).

For national authorities which aim to develop a national roadmap or strategy on coastal wetlands, this implementation roadmap helps in taking decisions on **which coastal wetlands to restore and why**. More specifically, it:

- **Provides insights and guidance on how to use the tools and results of RESTORE4Cs to improve the planning of coastal wetland restoration.**
- **Supports in defining priorities for coastal wetland restoration to contribute to the achievement of key policy targets for climate and biodiversity.**

The roadmap presents general principles and guidance which can be used by any EU country to prepare its own roadmap for coastal wetland restoration. The report outlines the main elements that national authorities and other stakeholders may include in a roadmap, at the same time, enhancing the integration of coastal wetlands into policies on climate neutrality and conservation.

There is no one-size-fits-all in applying this roadmap. Authorities and other stakeholders can focus on the roadmap elements which need most urgent attention in their own country setting considering current policy commitments. The application of the relevant RESTORE4Cs tools can help progress coastal wetland restoration for climate change mitigation and other co-benefits, based on the latest available EU data and state-of-the-art methods for assessing wetland conditions and planning restoration actions.

4 Otero, M. et al. (2024). *How can coastal wetlands help achieve EU climate goals?* Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

5 Ibid.

1.2 EU coastal wetlands & their role for climate and other co-benefits

Over the centuries, land reclamation, coastal development, overfishing and pollution have nearly eliminated European wetlands, and other productive and diverse coastal habitats[6]. In Europe, coastal wetlands are estimated to have been lost by more than 65% since the 1900s[7]. At the same time, most existing coastal wetlands are not in good condition, namely 91% are in a bad conservation status while only less than 3% are in good conservation status[8,9]. The deterioration of coastal wetlands condition has led to the loss of biodiversity in terms of species and habitats but also to the loss of significant soil carbon sinks and potentially to higher CO_2, methane (CH_4), and nitrous oxide (N_2O) emissions[10].

Climate change mitigation potential of restored coastal wetlands

The ecosystem services provided by healthy and restored coastal wetlands can help fulfil European and global commitments for climate change mitigation and adaptation. The ability of coastal wetlands to mitigate climate change is the sum of two services: (i) the accumulation of organic carbon (sequestration, gain of stock), and (ii) the capacity of reducing GHG emissions, particularly of forms with higher radiative potential, such as CH_4 (net GHG removal)[11]. Certain coastal wetland types like salt marshes can sequester carbon from their vegetation and via sedimentation besides storing large amounts of organic carbon in their soil due to their rapid growth and slow decomposition rates because of the saline and anoxic waterlogged conditions of the environment[12]. Further, the saline conditions of healthy coastal wetland soils have the advantage of potentially emitting only negligible amounts of other GHG such as CH_4, which is a substantially more potent GHG than CO_2[13,14].

see more
Policy Brief 1

However, the capacity of coastal wetlands to store carbon and offer GHG abatement is highly variable and dependent on the habitat and its condition. The combination of wetland degradation and wetland loss due to climate change and human activities diminish their sequestration capacity and can lead to the release of the stored carbon[15]. Different studies have shown that undisturbed coastal wetlands store nearly twice as much carbon as wetlands disturbed by

6 Airoldi, L., & Beck, M.W. (2007). *Loss, status and trends for coastal marine habitats of Europe*. Oceanography and Marine Biology, 45, 345-405.

7 Ibid.

8 Maes, J. et al. (2020). *Mapping and Assessment of Ecosystems and their Services: An EU ecosystem assessment - supplement.* Publications Office of the European Union, doi: 10.2760/519233, JRC120383.

9 Misteli, B. et al. (2023). *Case Pilots overview and context setting.* Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under Work Package (WP) 4 – Climate mitigation services and C and GHG processes in wetlands).

10 Abdul Malak, D. et al. (2021). *Carbon pools and sequestration potential of wetlands in the European Union.* European Topic Centre on Urban, Land and Soil Systems, ISBN 978-3-200-07433-0.

11 McLeod, E. et al. (2011). *A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO_2*. Front. Ecol. Environ. 9, 552–560.

12 Macreadie, P.I. et al. (2019). *The future of Blue Carbon science*. Nat Commun 10, 3998.

13 Morant, D. et al. (2020). *Carbon metabolic rates and GHG emissions in different wetland types of the Ebro Delta.* PloS One 15(4): e0231713.

14 Otero, M. et al. (2024). *How can coastal wetlands help achieve EU climate goals? Policy Brief. RESTORE4Cs project*. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

15 Ibid.

human activities[16]. For instance, well-functioning salt marshes store and sequester quantities of carbon per unit area comparable to terrestrial forests and other wetland types[17]. Salt marshes in Europe are estimated to have soil carbon densities between 200 – 400 tons per hectare for just the top meter of soil, with an average annual rate of carbon sequestration potential of 166 – 282 gCm^{-2} when in healthy condition[18]. Figure 1 visualises the climate change mitigation function of restored coastal wetlands by restoring tidal flows.

RESTORING TIDAL FLOWS IN COASTAL WETLANDS CAN SIGNIFICANTLY REDUCE METHANE AND CO_2 EMISSIONS.

The construction of sea embankments, dykes, or tide gates has disrupted natural tidal flows in coastal wetlands, increasing methane emissions and reducing carbon sequestration. Restoring these tidal flows can help reestablish the wetlands' ability to reduce methane emissions and enhance CO_2 sequestration.

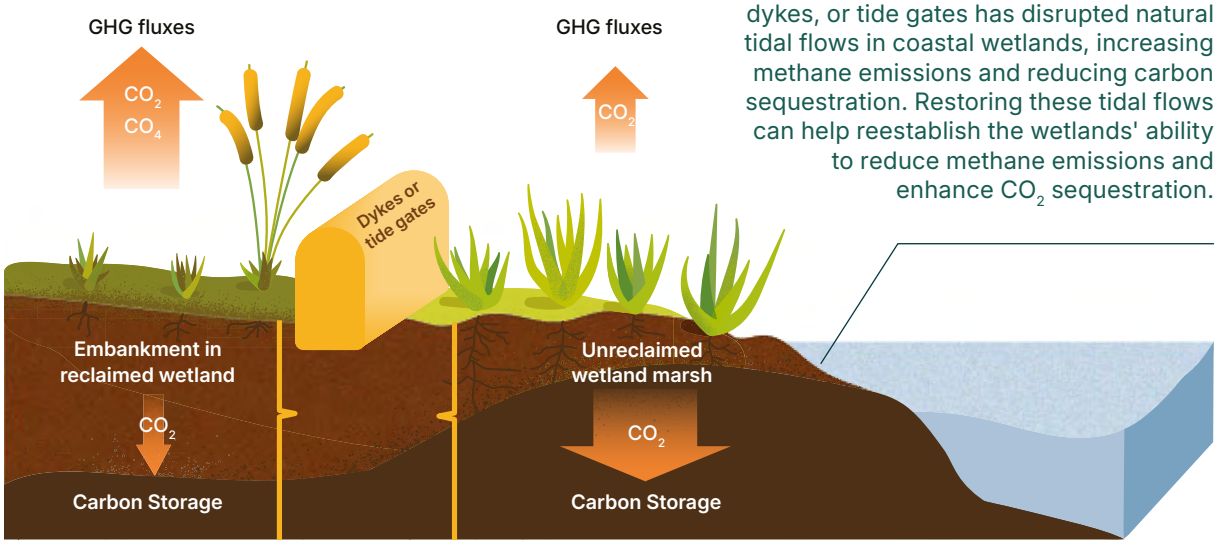


Figure 1: Coastal wetlands: Nature-based solution for storing carbon.
Source: RESTORE4Cs Policy Brief: How can coastal wetlands help achieve EU climate goals (2024)[19].

16 Otero, M. et al. (2024). *How can coastal wetlands help achieve EU climate goals? Policy Brief. RESTORE4Cs project.* Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

17 International Union for Conservation of Nature (IUCN) (2021). *Manual for the creation of Blue Carbon projects in Europe and the Mediterranean.* Otero, M. (Ed) 144 pp.

18 Abdul Malak, D. et al. (2021). *Carbon pools and sequestration potential of wetlands in the European Union.* European Topic Centre on Urban, Land and Soil Systems, ISBN 978-3-200-07433-0.

19 Otero, M. et al. (2024). *How can coastal wetlands help achieve EU climate goals?* Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

Other co-benefits of restored coastal wetlands

In addition to their role in the global carbon cycle, coastal wetlands are among the best examples of ecosystems with a large range of ecosystem services. Restored coastal wetlands provide the following additional co-benefits:

- **Biodiversity support:** Coastal wetlands are critical habitats as breeding, nesting, and feeding grounds of birds, fish, amphibians, and invertebrates.
- **Fisheries:** Coastal wetlands also support small-scale fisheries and aquaculture, boosting local food security as they serve as nurseries for commercially valuable fish and crustaceans.
- **Water quality improvement:** Coastal wetlands filter pollutants, excess nutrients, and sediments from surface water before it reaches coastal waters. This contributes to the reduction of eutrophication and harmful algal blooms.
- **Flood and storm protection:** Coastal wetlands offer increased resilience to extreme events for local communities. They buffer wave energy, can absorb storm surges, and buffer inland areas from coastal flooding. They can thus act as natural defences against sea-level rise and extreme weather events, increasing adaptation to climate change impacts.
- **Coastal erosion control:** Wetland vegetation stabilizes soil and sediments, reducing shoreline erosion.

02

Aligning with policy targets

2.1 EU policy targets relevant to this roadmap

Several international and EU policies in place aim to contribute to the sustainable management and conservation of wetland ecosystems. These policies span multiple policy fields, including nature and biodiversity, climate mitigation and adaptation, water resource management, and marine and coastal management. While coastal wetlands are rarely explicitly mentioned in policy texts, they are encompassed by policy targets and obligations that focus on wetland ecosystems.

Nature & Biodiversity policies

Key policies are the **Ramsar Convention (1971)**, the **Habitats (1992)** and **Birds (1979) Directives**, the **EU Biodiversity Strategy (2020)** and the **EU NRR (2024)**. The Ramsar Convention and the EU Birds and Habitats Directives set overarching objectives aimed at benefiting the state of coastal wetlands (Figure 2). While the Birds and Habitats Directives do not set specific end dates for maintaining or restoring key habitats and species to good conservation status, specific deadlines are often set at the national level in laws, national biodiversity strategies, or management plans for Natura 2000 designated sites.

The EU Biodiversity Strategy puts forward targets for increasing the level of protection to 30% of EU land and sea and strict protection to 1/3 of protected areas. The recently adopted EU NRR introduced legally binding targets to restore habitats not in good condition and re-establish habitats with different area-based targets by 2030, 2040 and 2050 (Figure 3).

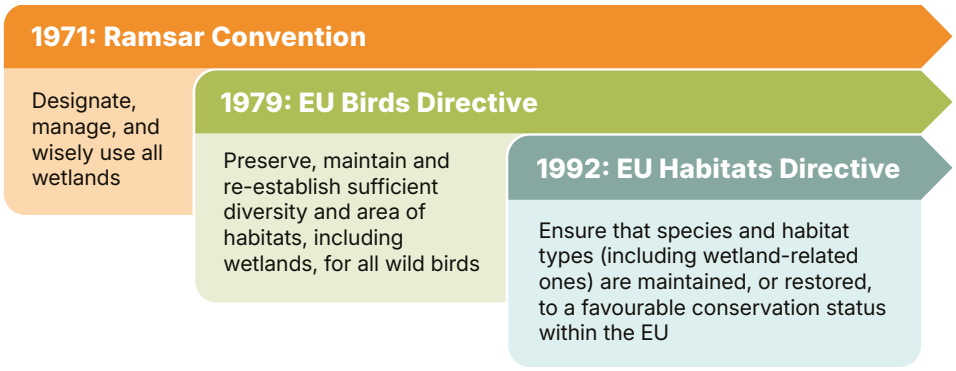


Figure 2: Objectives of the Ramsar Convention, EU Birds Directive and EU Habitats Directive.

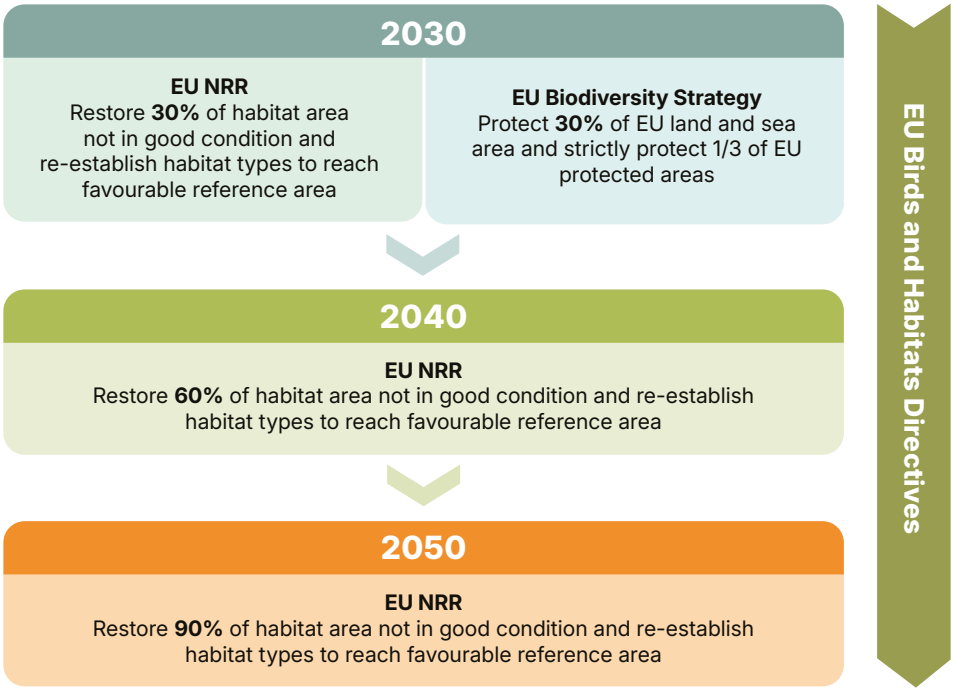


Figure 3: Key EU policies for coastal wetlands in nature & biodiversity field.

Climate change mitigation & adaptation policies

The **EU LULUCF Regulation (2018)** sets specific targets for the removal of 310 Mt CO_2 eq by the LULUCF sector by 2030, taking into account emissions and removals from wetlands. The **Sustainable Carbon Cycles Communication (2021)** puts forward objectives for wetlands restoration and the promotion of blue carbon farming, while the protection of wetlands as carbon stores is also required under the new **Common Agricultural Policy (CAP) (2021)**. The **EU Carbon Removal and Carbon Farming (CRCF) Regulation (2024)** aims to contribute to achieving climate neutrality by 2050 and reducing GHG emissions through, *inter alia*, the promotion of carbon farming, which can include coastal wetland restoration and conservation projects. The **EU Taxonomy for Sustainable Activities (2020)** helps direct investments towards sustainable activities, including restoration of wetlands as NbS for adaptation and sustainable investment for climate neutrality. All these policies aim to contribute to the achievement of climate neutrality by 2050. Figure 4 presents an overview of key policy targets, including their target years, as set out in these EU policies.

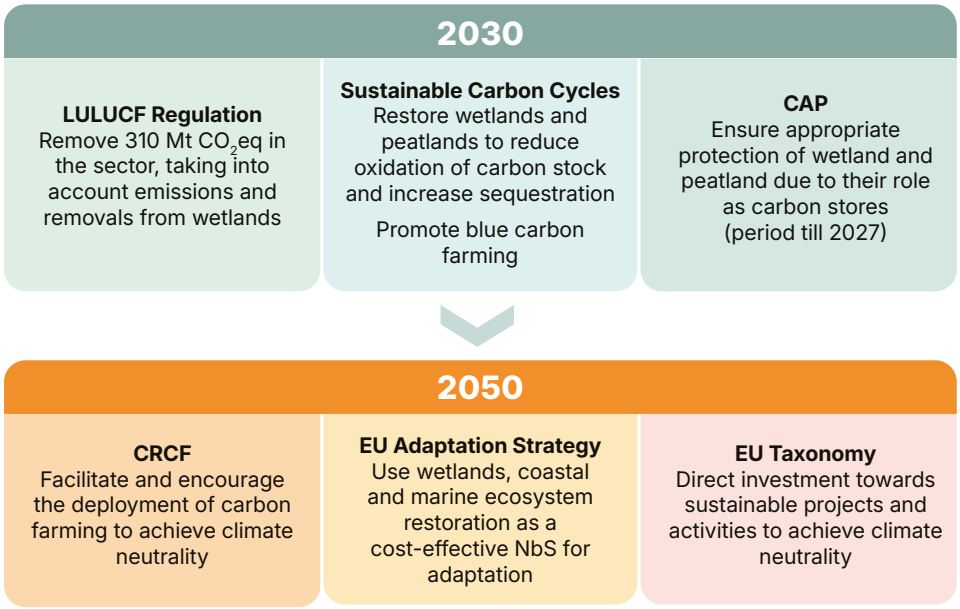


Figure 4: Key EU policies for coastal wetlands in climate change mitigation and adaptation field.

Ocean & water policies

Further key policy targets relevant to coastal wetlands come from water and ocean policies, namely the **Water Framework Directive (WFD) (2000)** and **Marine Strategy Framework Directive (MSFD) (2008)** requiring actions to reach good status for transitional, coastal and marine waters. Also, regional sea conventions, namely the **Barcelona Convention for the Mediterranean (1976)** with specific provisions to restore and protect coastal wetlands, the **Helsinki Convention for the Baltic Sea (1992)** on wetland restoration to reduce eutrophication and the **OSPAR Convention for the North-East Atlantic (1992)** with provisions to restore wetlands for both carbon and nutrients sequestration. Figure 5 summarises key policy targets with relevance for coastal wetlands, as embedded in these EU policies and multilateral agreements.

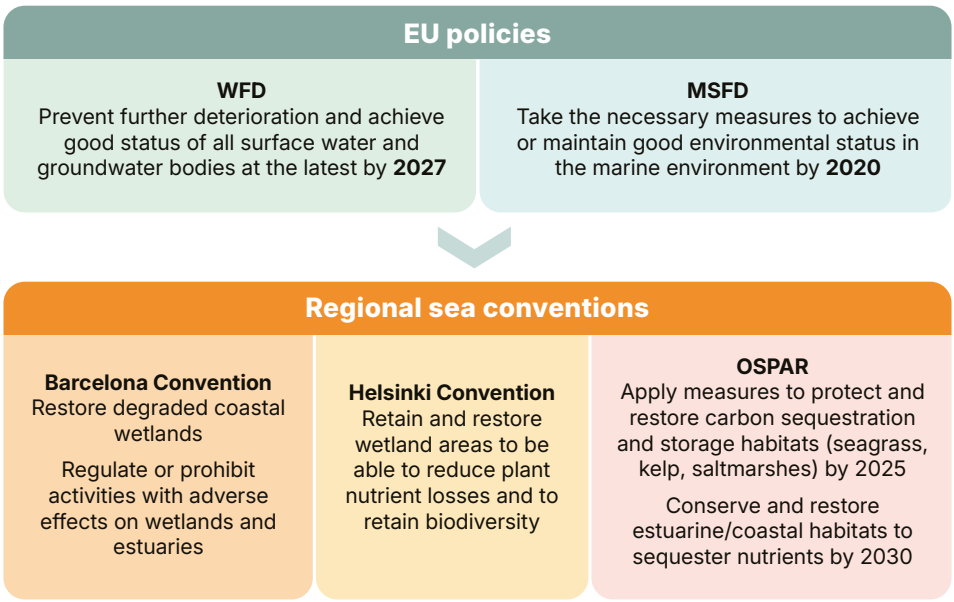


Figure 5: Key EU policies on coastal wetlands in the water and marine policy field.

2.2 EU reporting milestones relevant to coastal wetlands

Different EU policies which are relevant to the restoration and conservation of coastal wetlands include reporting requirements that contribute to the knowledge base on wetland status, monitoring, protection, and management. Figure 6 below presents a summary of key EU policy reporting milestones relevant to coastal wetlands with focus on the Habitats & Birds Directives, the EU NRR, the LULUCF Regulation, WFD and MSFD.

Habitats & Birds Directives

Conservation status and trends periodic reporting	2025, 2031, ...	-> Periodic reporting every six years on conservation status and trends under Art. 17 and on the implementation of conservation measures

EU Nature Restoration Regulation

National Restoration Plans & progress reports	9/2026	-> Draft National Restoration Plans covering the period until 2050
	9/2027	-> Final National Restoration Plans
	6/2031	-> First national reports on progress in implementing the National Restoration Plan; submitted every six years and includes the results of monitoring
	7/2032	-> National Restoration Plans are revised and supplementary measures are included; revised every 10 years

LULUCF Regulation

National GHG inventories	2026 – 2030	-> For the period from 2026 to 2030, accounting based on reported GHG emissions and removals from the LULUCF sector occurring in wetlands is obligatory
		-> Member States must include LULUCF sector data in their annual GHG inventories submitted to the EC and UNFCCC

WFD & MSFD

Management Plans & Programmes of Measures	2026	-> Under MSFD, Member States submit a Programme of Measures aimed at achieving good environmental status for all European marine waters every six years – next due in 2026
	2028	-> Under WFD, Member States submit River Basin Management Plans including Programme of Measures every six years aimed at achieving good status for all European waters by 2027 – next due in 2028

Figure 6: Key EU policy reporting milestones relevant to coastal wetlands.

2.3 Key policy gaps and challenges

The RESTORE4Cs analysis of policies and feedback from end-users' workshops conducted during the period 2023 – 2025[20] pointed to a number of issues which present challenges in coastal wetland restoration efforts and the implementation of the relevant policies in a consistent way.

- **Definitions of coastal wetlands in EU policies.** EU policies generally overlook coastal wetlands, with most relevant definitions coming from international frameworks like the Ramsar Convention. The Habitats Directive, the EU NRR, and the EU Taxonomy Regulation are exceptions: the Habitats Directive and the EU NRR specifically identify coastal wetland habitats, while the EU Taxonomy directly applies the Ramsar definition of wetlands. In contrast, the LULUCF Regulation, and the CRCF Regulation neither define nor directly or clearly address coastal wetland ecosystems, underscoring a general lack of consistent terminology and focus on these ecosystems. Due to the absence of a unified, comprehensive EU definition of (coastal) wetlands, national-level definitions of wetlands, e.g. in the context of GHG inventories, remain unstandardised and heterogeneous.

- **Policy targets for coastal wetlands and their implementation.** At national level, there is a need for stronger policy implementation and integrated frameworks that harmonize objectives and actions across sectors to enable cohesive and effective management of coastal wetlands. Overlapping jurisdictions and fragmented governance structures often complicate data sharing and reporting, impeding coordinated efforts.

- **Data availability and quality.** Another key issue complicating coastal wetland restoration efforts is limited data availability and quality, often related to methodological gaps for data collection and monitoring. For example, the lack of standardised data on wetlands is an especially relevant issue to the Habitats Directive, under which the condition of wetlands is unknown for 48% of these habitats. Under LULUCF Regulation, Member States still find collecting reliable information for complete and accurate reports challenging[21]. The inconsistency of common data collection methodologies and the absence of uniform metrics hinder the harmonization of information and data sharing. The incorporation of new technologies into the data reporting framework for coastal wetlands has also been highlighted as a key challenge to enhance the accuracy, efficiency, and comprehensiveness of reporting.

- **Indicators availability.** Indicators play a crucial role in providing data to inform policy and management decisions. However, there is considerable variation in the selection and use of indicators across countries, which is a significant challenge for end-users. For instance, some countries, such as France, employ more than 15 indices or attributes relevant to coastal wetlands, while others, like Romania, lack a national agreement on the variables to be measured. Across most EU countries, there is a need for improvements to the indicators used when gathering information to monitor progress with policy implementation specifically related to coastal wetlands. Many indicators are derived from habitat extent data; however,

20 Kampa, E. et al. (2024). Policy analysis and policy demands for data, methods, and tools (Part A). Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

21 Duwe, M. et al. (2023). Can current EU climate policy reliably achieve climate neutrality by 2050? Post-2030 crunch issues for the move to a net zero economy. Berlin: Ecologic Institute, Oeko-Institut. Available at: https://www.ecologic.eu/sites/default/files/publication/2023/2157-EU-climate-policy-post-2030-discussion-paper-web.pdf.

extent is only weakly correlated with functional attributes (e.g., soil health, hydrological functions) and ecosystem services (e.g., carbon sequestration, flood protection), leading to insufficient data for analysing the performance of policy and restoration efforts. This is also the case on climate-related aspects as most data collection and reported indicators primarily focus on examining conservation measures and status while those to measure efforts and results on climate adaptation or mitigation services are used in a limited manner on a project time scale, if at all.

03

Roadmap for restoring coastal wetlands for climate change mitigation

3.1 Main blocks of action

The roadmap to implement RESTORE4Cs' knowledge for restoring coastal wetlands is structured as a strategic framework with focus on actions and coordination pathways at national level, which are crucial to guide more detailed planning of restoration actions at site-level.

The roadmap follows a decision-making logic in a stepwise approach, starting with a baseline assessment of coastal wetlands and policies at national level, moving to the operationalisation of relevant policy targets with appropriate indicators, prioritisation of coastal wetlands for restoration, and then proceeding to planning suitable restoration actions at the site level. In three cross-cutting thematic blocks, the roadmap underlines the importance of:

- integration of coastal wetland restoration in policies on nature and biodiversity, climate change mitigation and adaptation and other relevant policy fields,
- good governance structure, stakeholder participation and public-private partnerships to support coastal wetland restoration, and
- enabling capacities and increasing awareness (Figure 7).

Figure 7: Main blocks of action of implementation roadmap.

Each block of the roadmap is elaborated in more detailed elements which outline the main results, methods or tools from RESTORE4Cs which can be used to support authorities and practitioners in the specific step of the process (Figure 8). Each element of the roadmap addresses one or more decision-making questions, presented in Table 1.

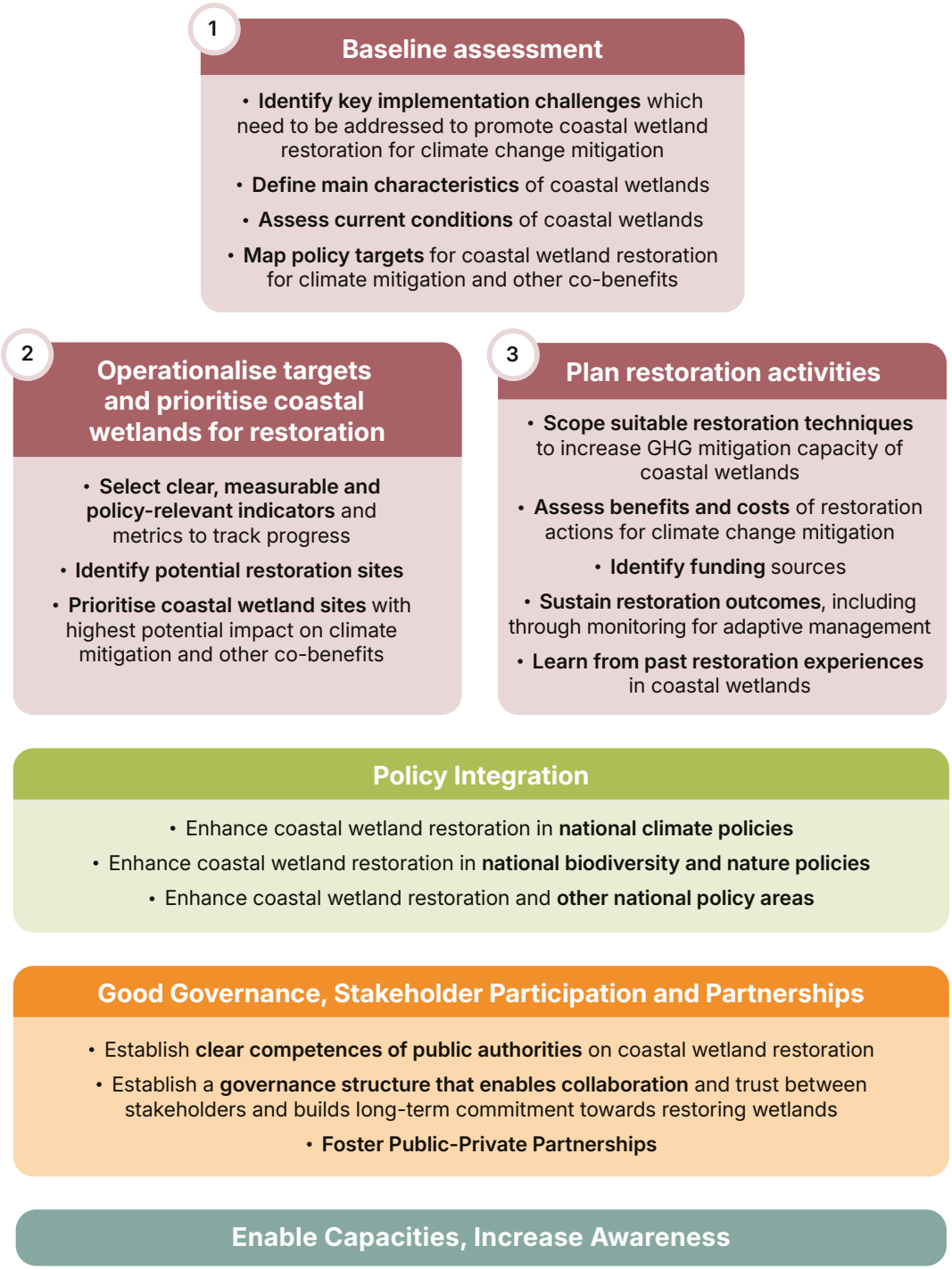


Figure 8: Overview of detailed elements in the blocks of the implementation roadmap.

Table 1: Overview of decision-making questions addressed in the roadmap.

BASELINE ASSESSMENT	
Identify key implementation challenges	→ What are key implementation challenges which need to be addressed to promote coastal wetland restoration for climate change mitigation?
Define main characteristics of coastal wetlands	→ Is a definition of coastal wetlands used in your national policy framework? Can it be improved? → How to delimit coastal areas for assessment and mapping activities? → What is the current extent of coastal wetlands? Which coastal wetland habitat types are present? → What area of coastal wetlands is currently protected?
Assess current conditions of coastal wetlands	→ What is the status of coastal wetlands? → What are main threats and pressures to coastal wetlands? → Is there a classification of coastal wetlands in place based on their health condition?
Map policy targets on coastal wetland restoration	→ Which key policy targets are in place on coastal wetland restoration in nature and biodiversity policies, climate policies and water, marine and coastal protection policies? → Are there policies at subnational level which support coastal wetland restoration? → What information, assessment or evidence can support the formulation of more specific policy targets for coastal wetland restoration?
OPERATIONALISE TARGETS AND PRIORITISE	
Select clear, measurable and policy-relevant indicators and metrics to track progress	→ Which indicators can be used to assess changes in the status of coastal wetlands over time and to assess and monitor progress against key policy targets? → How can policy-related metrics and indices be operationalised and mapped at different levels?
Identify potential restoration sites	→ In which areas have wetlands been lost through past land-use conversion? → Which lost wetlands have the highest potential for regeneration and recreation of wetland habitats and hydrological processes?
Prioritise coastal wetland sites with highest potential impact on climate mitigation and other co-benefits	→ Which coastal wetlands to restore and why? → What criteria can be used to prioritise wetland sites for restoration? → Where can coastal wetland restoration maximise co-benefits for climate mitigation, biodiversity conservation and socio-economic resilience?

PLAN RESTORATION ACTIVITIES	
Scope suitable restoration techniques to increase GHG mitigation capacity of coastal wetlands	→ Which types of restoration actions in coastal wetlands increase carbon sequestration and reduce GHG emissions by lowering pressures and reducing impacts?
Assess benefits and costs of restoration actions for climate change mitigation	→ What are the most cost-effective wetland restoration actions for climate mitigation? → How are different wetland restoration options perceived across multiple benefits (social, environmental, economic) in a given context? → Which restoration actions are most socially acceptable in a given context?
Identify funding sources	→ How to pay for coastal wetland restoration? → What is the most accessible funding source? → Can conservation and restoration actions be financed with private funding? → How can financing needs for long-term restoration and maintenance be matched with suitable public and private instruments?
Sustain restoration outcomes, including through monitoring for adaptive management	→ How to ensure the sustainability of restoration outcomes in the long term?
Learn from past restoration experiences in coastal wetlands	→ How to identify good practices and methodologies for restoring coastal wetlands?
POLICY INTEGRATION	
Enhance coastal wetland restoration in national climate, biodiversity, nature restoration and other policies	→ How to improve integration of coastal wetlands in national policies relevant for EU and international targets on climate, biodiversity and other policies? → How can policy targets be further specified to support restoration actions for coastal wetlands?
GOVERNANCE, STAKEHOLDER PARTICIPATION AND PARTNERSHIPS	
Establish clear competences of public authorities on coastal wetland restoration	→ Which public authorities have competences on coastal wetland restoration and conservation at national and regional level in different policy fields? → Which public authorities have competences on policy, planning, monitoring, enforcement for coastal wetland restoration and conservation? → Are competences overlapping and can be further improved to avoid conflicts?

Establish a governance structure that enables collaboration and trust between stakeholders and builds long-term commitment towards restoring wetlands	→ Which stakeholders may influence or be influenced by restoration? → Which stakeholders should be involved in the design of the restoration activities? → What methodologies can be used to identify, analyse and engage with stakeholders? → What are the best practices for building trust and long-term commitment for restoring wetlands? → How to consider the interests and knowledge on the coastal ecosystem of local communities and integrate this knowledge with scientific data?
Foster public-private partnerships	→ Which restoration options could attract private investment (e.g., via carbon credits to offset emissions)? → Where are public-private partnerships most feasible based on cost-effectiveness and ecosystem service benefits? → What role can national authorities play in creating enabling frameworks for public-private partnerships in wetland restoration?

3.2 Baseline assessment

3.2.1 Identify key implementation challenges for coastal wetland restoration in the context of climate change mitigation

→ What are key implementation challenges which need to be addressed to promote coastal wetland restoration for climate change mitigation?

To frame a national roadmap or strategy on coastal wetland restoration, key implementation challenges for coastal wetlands restoration should be identified in the specific country and/or regional context (see Annex 1 for a screening template on potential implementation challenges). Identifying key implementation challenges and ranking them in terms of their importance can help identify priorities for solutions and recommendations to be elaborated in a national implementation roadmap. Implementation challenges can be related to one or more of the following issues:

- Policy coherence and governance
- Quality and quantity of data
- Knowledge and capacity
- Planning and prioritisation of restoration
- Stakeholder engagement and awareness

A preliminary list of implementation challenges can be elaborated as a first step in the roadmap development process, based on expert knowledge, review of documents and exchanges with relevant stakeholders. The list of key implementation challenges should be further refined after collecting targeted information on coastal wetland characteristics, conditions and national policy targets relevant to their restoration as part of the "baseline assessment" described in the following sections.

3.2.2 Define main characteristics of coastal wetlands

- Is a definition of coastal wetlands used in your national policy framework? Can it be improved?
- How to delimit coastal areas for assessment and mapping activities?
- What is the current extent of coastal wetlands in your country? Which coastal wetland habitat types are present?
- What area of coastal wetlands is currently protected?

Coastal wetlands occupy the dynamic land-sea interface where marine, brackish, or freshwater processes interact. A clear and operational definition of coastal wetlands is essential for consistent national assessments, prioritisation of restoration actions, and alignment with EU policy obligations. The definition, extent, and boundaries of coastal wetlands are often subject to interpretation, resulting in knowledge gaps regarding the status of wetlands and their ecosystem services particularly in areas not officially recognised within national frameworks. Located at the land-sea transition zones, coastal wetlands face an additional challenge: the absence of consistent criteria to distinguish between different habitat types such as saltmarshes, seagrass meadows, intertidal flats, freshwater wetlands, and coastal lagoons. Despite their distinct ecological functions, restoration requirements, and potential contributions to climate change mitigation, these habitats are frequently grouped together under "marine" or "transitional water" ecosystems or overlooked, complicating effective management and policy implementation.

Support from RESTORE4Cs

The work conducted in RESTORE4Cs advanced a harmonised definition of coastal wetlands, aligned with the Ramsar Convention on Wetlands (1971), that captures the full land–sea continuum where salt, brackish, and fresh waters interact and recognises the wide diversity of habitats found in Europe's coastal watersheds[22]. The definition of coastal wetlands developed in RESTORE4Cs is presented in the box below.

What are coastal wetlands?

Coastal wetlands are areas along coastlines that are temporarily or permanently flooded by salt, brackish or fresh water. These ecosystems are characterised by phreatophylic and submerged vegetation. According to the Ramsar Convention, coastal wetlands include "water that is static or flowing, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six meters"[23]. European coastal wetlands include seagrass, tidal and freshwater marshes as well as tidal and non-tidal flats and creeks.

22 Abdul Malak, D., Sánchez-Espinosa, A., Otero, M.M., & Schröder, C. (2025). *Advancing a coherent framework for assessing European coastal wetland condition.* Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-8-v5_Final.pdf.

23 Ramsar Convention. (1971). *Convention on Wetlands of International Importance especially as Waterfowl Habitat* (Art. 1). Ramsar, Iran. Available at: https://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf.

These habitats can be found in coastal lagoons, estuaries, and other transitional waters, as well as in fjords, sea lochs, and embayments[24].

Curonian Lagoon, Lithuania
Source: © RESTORE4Cs, University of Salento/LIFEWatch ERIC

Building on this refined definition, a range of spatial mapping tools and data layers have been developed under RESTORE4Cs to assist countries in clarifying the conceptual definition of coastal wetlands in their national framework, determining how to spatially delimit coastal zones for assessment, and establishing the current extent and protection status of coastal wetlands at national level.

go to the ***interactive tool***

The **Extent and Condition Assessment Tool** in the European Coastal Wetlands Interactive Platform provides national summaries, time series, and visualisations, including:

- total coastal wetland area (km² and % change over time),
- distribution of habitat types (e.g. saltmarsh, lagoon, seagrass, tidal flat) (see Figure 9 exemplifying the distribution of coastal wetland habitat types in Portugal),
- percentage of wetland area under protection:
  - nationally designated protected areas,
  - Natura 2000,
- unprotected or poorly represented habitats,
- geospatial layers showing wetland coverage and fragmentation.

24 Otero, M. et al. (2024). *How can coastal wetlands help achieve EU climate goals?* Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

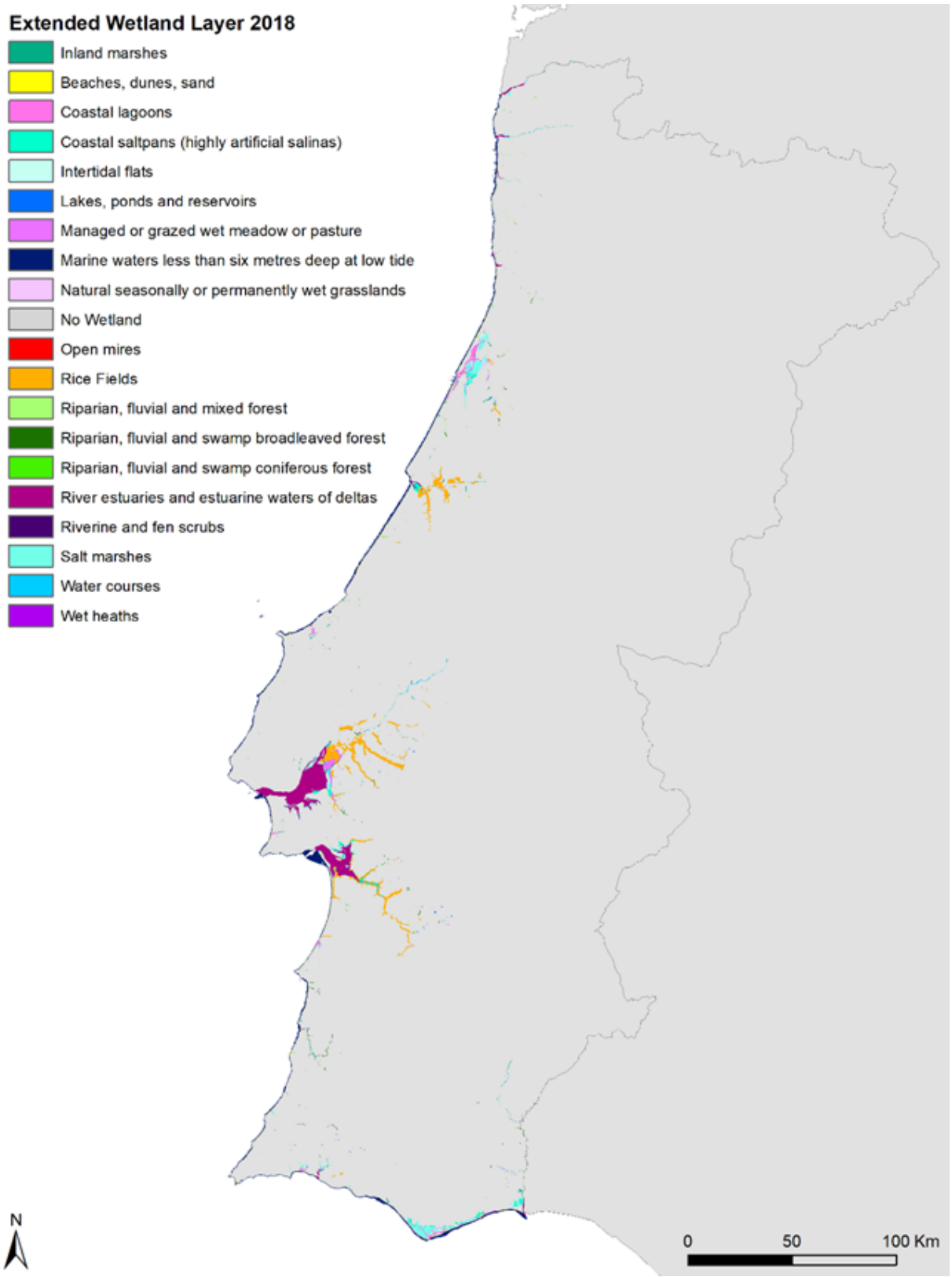


Figure 9: Map on extent of coastal wetlands in Portugal.
Source: Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform (based on Extended Wetland Layer).

To support national-level planning, all datasets on coastal wetlands in the Extent and Condition Assessment Tool are produced through validated remote-sensing and geographic information systems (GIS) analyses, harmonised across Europe to ensure comparability. Countries can use these harmonised outputs as the starting point for their own roadmap implementation. The first step is to establish a baseline by adopting the EU-wide coastal wetland boundaries as a consistent reference. These boundaries capture the ecological processes that structure wetlands and provide a reliable foundation for monitoring their extent and condition. The second step is to align national assessments with this baseline by integrating the harmonised datasets into national inventories. While the EU-wide framework ensures comparability, at the national level countries may refine and increase the precision of boundaries to reflect local ecological processes, management priorities, and restoration needs. This dual approach, harmonised at the European scale but more detailed at the national scale, allows both consistency and accuracy in monitoring and policy integration[25].

Key recommendations

- → Adopt a **consistent EU-wide baseline definition of coastal wetlands, based on the harmonised definition developed by RESTORE4Cs**. In this context, leverage RESTORE4Cs' harmonised spatial tools and data layers, while refining boundaries at the national level to increase precision and reflect local ecological processes.
- → At national level, ensure that a **clear and operational definition of coastal wetlands is formally embedded in national legislation**, providing a legal basis for consistent assessments, restoration prioritisation, and compliance with EU policy obligations.
- → Use the Extent and Condition Assessment Tool to **establish a national baseline** for coastal wetland area, type distribution, and protection coverage.
- → **Integrate harmonised spatial datasets** from RESTORE4Cs into national inventories to identify underrepresented coastal wetland types.

Where to find more information

- **RESTORE4Cs European Coastal Wetlands Interactive Platform:** Extent and Condition Assessment Tool.
- **RESTORE4Cs Deliverable:** Methodological description of information layers (2024). Available at: https://www.restore4cs.eu/about/workplan/ (Under WP6 – Upscaling and integration for assessment of the status and restoration potential of wetlands in Europe)[26].
- **RESTORE4Cs Policy Brief No. 8:** Advancing a coherent framework for assessing European coastal wetland condition (2025)[27].

25 Abdul Malak, D. et al. (2025). *Advancing a coherent framework for assessing European coastal wetland condition.* Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-8-v5_Final.pdf.

26 Authors: Brand, A., Franke, J., Guelmami, A., Bègue, N., Adamo, M.P., Otero, M.M., Schröder, C.

27 Authors: Abdul Malak, D., Sánchez-Espinosa, A., Otero, M.M., Schröder, C.

3.2.3 Assess current conditions of coastal wetlands

- What is the status of coastal wetlands?
- What are main threats and pressures to coastal wetlands?
- Is there a classification of coastal wetlands in place based on their health condition?

Understanding the current condition of coastal wetlands is a critical step in a national restoration roadmap or strategy. Assessing the condition provides a baseline against which progress can be measured, helps identify priority areas for intervention, and enables national authorities to meet reporting obligations under the EU NRR, the Habitats and Birds Directives, the WFD, the MSFD and the LULUCF Regulation. Most EU Member States do not yet maintain a dedicated national classification of coastal wetland health. Existing systems typically relate to broader habitat reporting (Habitats Directive), water status assessments (WFD), or protected area management. RESTORE4Cs offers a practical, harmonised framework for classifying coastal wetland health that national authorities can adopt or use as a starting point.

Support from RESTORE4Cs

Assessing the status of coastal wetlands requires a combination of ecological, hydrological and land-use information. Coastal wetland condition can vary significantly depending on habitat type (e.g. saltmarshes, tidal flats, seagrass beds, freshwater marshes), degree of protection, and local pressures, while relevant data gaps need to be addressed with national monitoring efforts.

Conditions

Within the Extent and Condition Assessment Tool on the European Coastal Wetlands Interactive Platform, RESTORE4Cs provides a thorough assessment which is drawn on five dimensions of ecosystem condition, aligned with international typologies (System of Environmental-Economic Accounting – Ecosystem Accounting (SEEA EA), Mapping and Assessment of Ecosystems and their Services (MAES)) and operationalised in RESTORE4Cs:

1. **Physical state** (including soil moisture deficit during the vegetation growing season and sea water salinity),
2. **Chemical state** (including percentage of samples classified as “good” or “excellent” state of bathing water),
3. **Compositional state** (including percentage of wetland species with good population status, richness of wetland species, and percentage of wetland birds with increasing or stable population trends),
4. **Structural state** (including annual mean Normalised Difference Vegetation Index (NDVI) and water occurrence decrease intensity),
5. **Landscape and seascape** (including connectivity and fragmentation).

Using these dimensions incorporated into the Extent and Condition Assessment Tool, authorities and practitioners can determine[28]:

- the share of coastal wetlands in good, moderate, poor or unknown condition,
- differences between wetland types and biogeographic regions,
- trends over time (e.g. 2000–2021 for many indicators).

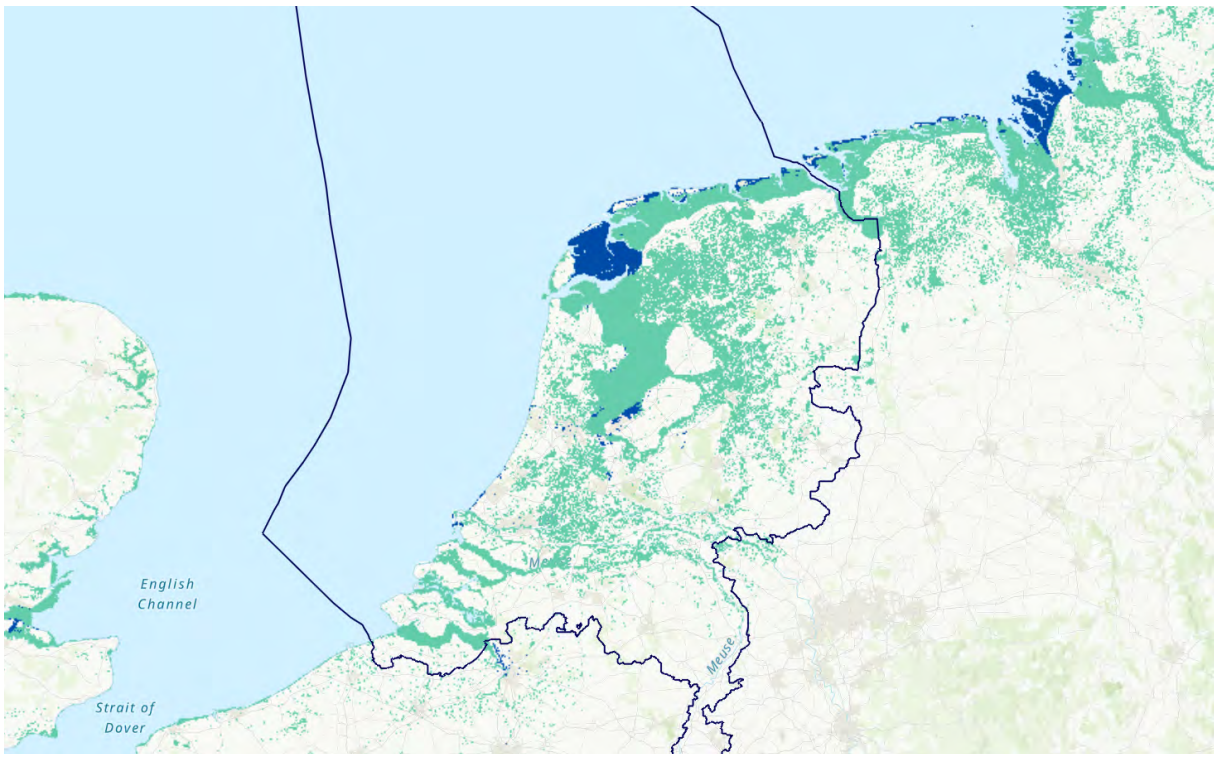
Where available, national information (e.g. Habitats Directive Art. 17 reporting, Birds Directive Art. 12 reports, national wetland inventories, Natura 2000 management plans) should be combined with RESTORE4Cs' indicators to refine national condition assessments.

Drivers and pressures

Coastal wetlands are exposed to multiple pressures that degrade ecological condition and reduce their climate change mitigation potential. A robust threats analysis is essential to guide restoration prioritisation and policy responses. The Extent and Condition Assessment Tool identifies five major groups of pressures, each linked to specific spatial indicators:

1. **land-use change** (including the percentage of wetland area covered by nationally designated areas and Natura 2000, the extent of agricultural area around wetlands (see Figure 10 as an example), and the imperviousness of the local drainage basin),
2. **climate change** (including drought event frequency, extreme drought frequency, trends in sea level, and surface air temperature anomalies),
3. **pollution** (including exceedance of critical loads for eutrophication and non-atmospheric nitrogen inputs to soil),
4. **direct exploitation** (water exploitation index (WEI+)), and
5. **invasive alien species**.

28 Most indicators used to operationalise the five dimensions of ecosystem conditions are derived from data that are regularly updated by external sources. On the European Coastal Wetlands Interactive Platform, each indicator layer includes metadata referencing the underlying source data.



Legend: Wetlands exposed to agricultural areas: Not exposed Exposed Condition data not available

Figure 10: Example of a map capturing the extent of agricultural area around wetlands in the Netherlands. Source: Extent and Condition Assessment Tool on the European Coastal Wetlands Interactive Platform.

In this context, the role of wetland use intensity layers deserves particular attention, as they provide a critical means of quantifying pressures from agricultural activities, as one of the main drivers of coastal wetland degradation. The wetland use intensity layer[29], derived from Sentinel-2 time-series data, helps identify areas that should be prioritised for ecological preservation. It can also serve as a benchmark for assessing the impact of restoration efforts over time. At the national level, these harmonised datasets form the baseline, while additional local-scale data can be incorporated to increase precision, capture site-specific ecological processes, and ensure that restoration priorities are tailored to national realities.

When combined with conditions indicators, these types of pressure maps help identify restoration priorities such as:

- Wetlands at high ecological risk
- Wetlands under multiple interacting pressures
- Wetlands where hydrological or water-quality restoration would have the highest impact

29 Remote Sensing Solutions. (2025). Wetland Use Intensity (WUI) Dataset for European Wetlands in coastal zones (Version 2023) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.17660102.

Integrating these maps with information on protection levels, habitat types, and restoration potential (see section 3.3), strengthens the criteria for selecting restoration sites, ensuring that interventions are directed to areas where they can most effectively maintain or enhance ecosystem services.

RESTORE4Cs provides harmonised datasets for all these pressures, enabling national authorities and practitioners to conduct a standardised assessment on drivers and pressures. Countries can use this approach to categorise each coastal wetland type into:

- Good condition (no significant anomalies; favourable species trends; low pressure levels)
- Moderate condition (some anomalies or moderate pressures; potential early degradation)
- Poor condition (multiple significant anomalies; impaired hydrology; degraded vegetation; high pressures)
- Unknown condition (insufficient data)

This classification is fully compatible with the EU NRR, which requires Member States to quantify both:

- areas in good condition, and
- areas in not-good condition that must be restored.

While this EU-wide classification ensures comparability across Member States, national and local authorities are encouraged to refine the baseline with higher-precision data. Incorporating site-specific monitoring, hydrological measurements, and ecological surveys increases accuracy, captures local processes, and ensures that restoration priorities reflect national realities.

The Extent and Condition Assessment Tool indicators provide a ready-to-use toolbox to support this classification exercise. Table 2 provides examples of types of information findable regarding **drivers (blue)** and **conditions (green and orange)** on the Extent and Condition Assessment Tool on the European Coastal Wetlands Interactive Platform.

Table 2: Selection of drivers and conditions indicators on European coastal wetlands.

Indicator typology (IPBES and SEEA EA)	Indicator name	Description	Policy index	Reference value (positive assessment)
Land-use change	**Extent of agricultural area around wetlands**	This indicator measures the percentage of cropland area in a 10-km buffer area around wetlands as a measure of pressure from agricultural activity.	**POL 22:** Share of Agricultural Area in Coastal Wetlands	**≤30% of crop area of the local drainage basin**
Land-use change	**Percentage of wetlands area covered by Natura 2000**	This indicator measures Natura 2000 network protection of wetlands.	**POL 04:** Total Coastal Wetland Extent in N2000 sites **POL 05:** Individual Coastal Wetland Habitat Extent in N2000	**Wetland covered by Natura 2000**
Climate change	**Drought events frequency (DRF)**	This layer measures the duration and intensity of droughts.	**POL 13:** Coastal Wetland Habitat Condition Index **POL 25:** Coastal Wetland Vulnerability Index	**No drought warnings longer than one month**
Climate change	**Trends in sea level**	This layer shows the trend in sea level rise in areas surrounding coastal wetlands, which may be affected at some extent by marine waters.	**POL 13:** Coastal Wetland Habitat Condition Index **POL 25:** Coastal Wetland Vulnerability Index	**No statistically significant increasing trends (z-score >1)**
Landscape	**Fragmentation**	This indicator measures wetland ecosystems fragmentation based on the presence of artificial infrastructures.	**POL 13:** Coastal Wetland Habitat Condition Index	**Effective Mesh Density ≤10**
Com-positional state	**Richness of wetland species**	Number of wetland species based on data from Article 12 reporting of the Birds Directive and Article 17 of the Habitats Directive.	**POL 14:** Coastal Wetland Biodiversity (Species) Condition Index	**N/A**

Source: Extent and Condition Assessment Tool on the European Coastal Wetlands Interactive Platform.

Risks and uncertainties

Conditions assessments inevitably involve uncertainties. Authorities should acknowledge:

- limited resolution of some EU-wide datasets (e.g. climate anomalies at coarse scale),
- national inconsistencies in wetland typologies and monitoring practices,
- underrepresentation of small or fragmented wetlands in remote sensing products,
- potential misinterpretation of short-term anomalies (e.g. drought year effects).

These uncertainties are important to keep in mind but should not prevent the use of available indicators and pressures provided in the Extent and Condition Assessment Tool for baseline assessments.

Key recommendations

→ Use the **indicators in the** Extent and Condition Assessment Tool for wetland pressures and ecological condition, including the wetland use intensity layer, to strengthen national assessments.

→ **Combine these indicators with national information** (e.g. Habitats Directive Art. 17 reporting, Birds Directive Art. 12 reports, national wetland inventories, Natura 2000 management plans), where available.

→ In view of the National Restoration Plans, estimate the **area of coastal wetlands falling under Annex I and Annex II of the Nature Restoration Regulation** which is currently not in good condition (within and outside Natura 2000 areas).

→ Where a lack or absence of data for assessing the condition of wetlands is identified, **increase monitoring and data collection efforts**. This is particularly important with reference to connectivity, barriers, chemical pollutants, and conservation status of regional coastal wetland species and habitats.

Where to find more information

- **RESTORE4Cs European Coastal Wetlands Interactive Platform:** Extent and Condition Assessment Tool.
- **RESTORE4Cs Policy Brief No. 6:** European Coastal Wetland Indicators: A proposal for monitoring policy processes across space and time (2025)[30].

30 Authors: Otero, M. M., Abdul Malak, D., Sanchez A., Schröder, C., Kampa, E., Bueb B., Elkina, E., Guelmami, A., Camacho, A., Marangui, C., Lillebø, A.

3.2.4 Map policy targets on coastal wetland restoration for climate change mitigation and other co-benefits

- → Which key policy targets are in place on coastal wetland restoration in nature and biodiversity policies, climate policies and water, marine and coastal protection policies?
- → Are there policies at subnational level which support coastal wetland restoration?
- → What information, assessment or evidence can support the formulation of more specific policy targets for coastal wetland restoration?

The current policy landscape plays a key role in effectively planning coastal wetland restoration, it is thus important to identify and clarify policy targets for coastal wetlands restoration and conservation at the EU and country level. Clear policy objectives and targets provide a foundation for restoring ecosystem functions and are also key for priority-setting, communication, and stakeholder coordination. Additionally, well-defined and specific targets help secure funding and streamline implementation, ultimately enhancing the effectiveness and impact of restoration efforts[31,32].

A series of steps is proposed for a baseline analysis of policies for coastal wetland restoration:

1. **Identify existing national policies relevant for wetland restoration and conservation across various policy fields**, in particular on nature conservation, marine and coastal policies, water management, and climate change mitigation and adaptation.
2. **Identify wetland restoration and conservation targets** embedded within these policies, with a particular focus on coastal wetlands.
3. **Cross-check alignment** of national policy targets with key EU and global commitments for (coastal) wetland restoration and conservation. Pay particular attention to binding obligations and identify any conflicts, inconsistencies or gaps to be addressed.
4. **Further specify targets** to translate high-level policy goals into more actionable restoration and conservation targets for coastal wetlands (see also roadmap section 3.5 on "Policy integration"). The targets can be further specified based on latest and solid scientific evidence, including what is gathered during the first steps of the baseline assessment, the RESTORE4Cs assessment tools presented in this roadmap and recent policy developments. The specification of targets can relate to, for example, the type and extent of (coastal) wetland ecosystems to be restored or protected, the timeframe of the restoration activities, and particular ecosystem services to be enhanced.

31 Doherty, T. S. et al. (2018). *Expanding the Role of Targets in Conservation Policy. Trends in ecology & evolution*, 33(11), 809–812. https://doi.org/10.1016/j.tree.2018.08.014.

32 MARCO. (2016). *Analysis for the Mid-Atlantic Regional Council on the Ocean (MARCO) to support a Framework for prioritizing wetlands as Natural and Nature-Based Features for Climate Risk Reduction and Resilience.* Environmental Law Institute. Available at: https://www.eli.org/sites/default/files/files-pdf/Targeting-Conservation-and-Restoration-in-the-MARCO-Region-Final-Report-December-2016.Cover_.pdf.

Support from RESTORE4Cs

The RESTORE4Cs policy inventory[33] provides a comprehensive analysis of the most relevant international and EU policies for coastal wetland restoration, aimed at climate change mitigation and other co-benefits. This includes an overview of all relevant binding and non-binding targets at international and EU levels.

To guide the analysis of national policies for coastal wetland restoration, a national policy assessment framework was developed in RESTORE4Cs[34]. This framework helps to map key elements of national governance structures and policy instruments, including their policy objectives, targets, and implementation mechanisms. This type of analysis draws on a review of relevant policy documents, literature and expert knowledge. A structured policy template to carry out the mapping of relevant national policies and policy targets is provided in Annex 2.

The RESTORE4Cs Deliverable "Policy analysis and policy demands for data, methods, and tools" presents the national policy frameworks of six European countries (France, Lithuania, Portugal, Romania, Spain, and the Netherlands) highlighting national approaches and good policy practices. For each of these countries, detailed inventories of national legal and policy instruments related to coastal wetland conservation and restoration have been compiled.

To guide other countries in such analysis, the inventory of French laws and policies is presented as a detailed case example in Annex 3 with main highlights shown below in Table 3.

Table 3: Policy inventory France: Key legal and policy instruments setting forth specific targets or measures for coastal wetland conservation and restoration.

Name of policy	Policy targets and objectives and specific measures for coastal wetlands
NATURE AND BIODIVERSITY POLICIES AT NATIONAL LEVEL	
The 4th National Wetlands Plan 2022–2026 under the National Biodiversity Strategy 2030	Specific objectives for wetland restoration: • **double the surface area of wetlands under high protection in mainland France by 2030** and strengthen the inclusion of these environments in all protected areas in mainland France, i.e. an increase of around 110,000 ha. A similar ambition will be pursued in all protected areas of various statuses; • **acquire 8,500 ha of wetlands** and create new protected areas, including a 12th national park dedicated to wetlands specifically; • **restore 50,000 ha of wetlands** by 2026; • improve the functioning of wetlands by **restoring watercourses**. With its third edition published in 2023, the **National Biodiversity Strategy 2021–2030** commits to continue efforts to restore wetlands as set out in the 4th National Wetlands Plan 2022–2026, **targeting 50,000 ha of restored wetlands by 2026**. It elaborates on the following objectives in relation to wetlands: • Action 1: Continue and set up wetland restoration initiatives with a target of 50,000 ha by 2026. • Action 2: Define a framework for identifying restoration priorities that should be ready in 2024.

33 Kampa, E. et al. (2024). *Policy analysis and policy demands for data, methods, and tools (Part A)*. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

34 Ibid.

	• Action 3: Strengthen resources and help operators to benefit from them. • Action 4: Strengthen the restoration capabilities of operators by developing the necessary ecological engineering (in terms of skills, know-how and equipment).
National Strategy for Protected Areas 2030 (2021)	• Aims to protect at least 30 % of the territory, including one third under strong protection (i.e. 10 % of the territory) and to intensify the protection of ecosystems of remarkable interest and particularly threatened. For this purpose, the Strategy aims to develop areas under strong protection, as a priority targeting remarkable biodiversity-rich ecosystems or those particularly vulnerable to future changes, such as **wetlands**. • It sets an objective to **double the surface area of wetlands under high protection** in metropolitan France without excluding the possibility of designating a wetlands national park.
CLIMATE POLICIES AT NATIONAL LEVEL	
3rd National Climate Change Adaptation Plan (2025)	• Adopted as an implementation instrument under the National Strategy for Adapting to Climate Change (2006). It consists of 52 measures, each setting forth a number of actions. The most relevant measures and actions are presented further below. • **Measure 3: Protecting the population from floods by adapting risk prevention policy.** Action 7: Facilitate and promote the maintenance of river and canals, and the management of aquatic environments through nature-based solutions (NbS) linked to flood prevention The deployment of these solutions at watershed level will help maintain flood expansion zones and wetlands, and the creation and maintenance of hedgerows, in line with the Hedgerow Pact, will help to slow down and reduce the impact of flooding • **Measure 4: Protecting the population from the consequences of coastal retreat by rethinking the development of exposed areas** • Action 1: Restore or maintain coastal forest habitats, dune ecosystems, seagrass beds, coastal grasslands, mangroves, coastal marshes and coral reefs and further develop flexible coastal management through NbS to limit coastline retreat and flooding and protect the coastal area (2025) • **Measure 20: Deploy NbS for adaptation** • **Measure 37: Supporting farms and the agri-food industry in the face of climatic hazards and initiating the transition to resilient, low-carbon models** • Action 6: Payments for Environmental Services (PES): identify indicators and deploy PES to maintain and develop grasslands, wetlands and agro-ecological infrastructure (2025–2027) • Action 7: Develop NbS in the aquaculture section (from 2024) • Action 28: Measure 30 of the Water Plan: Development of NbS • **Measure 43: Promotion the adaptation and resilience of natural environment and species to climate change** • Action 4: acceleration the restoration of river morphology, associated landscapes and wetland functions in line with the WFD and the aquatic aspects of the EU NRR (from 2024) • Action 10: Acceleration the coverage of French inventories (2025–2027) • Action 11: Monitor the evolution of wetlands under climate change through the development and use of a modelling tool (from 2024)
Label Bas-Carbone (Low Carbon Label) (2019)	• Governmental crediting scheme designed to incentivise projects that reduce emissions and sequester carbon, primarily in terrestrial ecosystems. Its primary objectives are to promote transparency and effectiveness in financing projects that contribute to France's 2050 GHG emission reduction targets. • In 2023, the scope was extended to include a method for valuing the carbon stock sequestered in ***Posidonia* meadows**, a seagrass habitat, undergoing degradation due to anchoring along France's Mediterranean coast. The scheme focuses solely on quantifying carbon sequestration resulting from the prevention of seagrass habitat degradation. This targeted approach, addressing a specific type of blue carbon ecosystem and threat, aims to streamline initiative development costs. Certified projects must undergo recertification every five years and can operate for up to 30 years.

WATER, MARINE AND COASTAL POLICIES AT NATIONAL LEVEL	
Law on the Development, Protection and Enhancement of the Coastal Zone (1986)	• It covers more than 1,200 municipalities bordering the sea, as well as large lakes, estuaries, and deltas. • A decree sets the list of areas and environments to be preserved, including in particular, depending on their ecological interest, coastal dunes and moors, beaches and lidos, **coastal forests and wooded areas, uninhabited islets and the natural parts of estuaries, rias or abers and capes, marshes, mudflats, wetlands and areas temporarily under water**, as well as **resting, nesting and feeding areas for the avifauna** designated by the Birds Directive.
National Strategy for Integrated Coastline Management (2012)	• It aims to strengthen the resilience of coastal areas by drawing on the role of natural coastal environments. These ecosystems are valuable assets in mitigating the effects of natural phenomena, such as marine submersion, erosion, flooding, etc. • Its key objective is to **protect and restore coastal ecosystems**, e.g. wetlands, dune belts, mangroves, coral reefs, which dissipate the sea´s energy and help limit the impact of coastal erosion on activities and property.

Source: based on the RESTORE4Cs Deliverable: Policy analysis and policy demands for data, methods, and tools (2024).

Key recommendations

- → Identify existing **national and subnational policies relevant for wetland restoration and conservation** across various policy fields.
- → Identify **wetland restoration and conservation targets** embedded within these policies.
- → Cross-check **alignment of national policy targets with key EU and global commitments** for (coastal) wetland restoration and conservation.
- → Adopt a **definition of coastal wetlands for consistent application across national policies** on biodiversity, climate and other policy fields, based on the definition of coastal wetlands developed by RESTORE4Cs (see roadmap section 3.2.2 on "Define main characteristics of coastal wetlands").
- → If national targets for coastal wetland restoration and conservation are missing, define the type of **information and evidence needed to define actionable and quantified targets for coastal wetlands**. Support can be provided by RESTORE4Cs' methods and tools presented in this roadmap such as maps of potentially restorable wetlands.

Where to find more information

- **RESTORE4Cs Deliverable:** Policy analysis and policy demands for data, methods, and tools (Part A) (2024). Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance)[35].

35 Authors: Kampa, E., Bueb, B., Elkina, E., Otero, M.M., Abdul Malak, D., Schröder, C., Sanchez, A., Guelmami, A., Ronse, M., Kataržytė, M., Vaičiūtė, D., Bučas, M., Raoult, J., Speijer, F., Lillebø, A., Carvalho, T., Geamănaă, N., Cazacu, C., Racoviceanu, T., Camacho, A.

3.3 Operationalise targets and prioritise

3.3.1 Select clear, measurable and policy-relevant indicators and metrics to track progress of coastal wetland restoration and its impact on climate change mitigation

- → Which indicators can be used to assess changes in the status of coastal wetlands over time and to assess and monitor progress against key policy targets?
- → How can policy-related metrics and indices be operationalised and mapped at different levels (using spatial indicators, information levels)?

With a conservation and restoration policy landscape becoming more complex and demanding, there is a need for strong evidence and analytical tools to inform the policymaking and implementation processes.

In the EU, monitoring indicators for tracking wetland ecosystem conservation vary based on policy frameworks, predominantly found in the nature conservation field. For example, the Habitats Directive requires monitoring and reporting of species and habitat condition, and conservation status through habitat extent, structure, and function, but there are several limitations regarding data quality and availability. The WFD focuses on ecological and chemical status indicators, measuring water quality, hydromorphological conditions, and biological quality elements. With the EU NRR introducing new binding targets for ecosystems restoration, including coastal habitats, there is a need to develop comprehensive indicators to measure progress on wetlands restoration.

To meet monitoring obligations under existing environmental policies, national indicator systems have been established with primary focus on protected areas, water quality, and ecological status. However, these systems may not fully align with coastal wetland geography and new policy objectives. Therefore, a more comprehensive and unified approach is necessary to better capture coastal wetland ecosystem functions and meet policy targets[36].

To effectively operationalise coastal wetland-relevant policy targets, it is necessary to:

1. **Use clear, measurable indicators and metrics** to accurately assess the baseline of wetland ecological status and resilience. These indicators must also assess changes in the status of coastal wetlands over time and answer what is required to be monitored to track progress and measure it against national and EU policy targets for climate and biodiversity.
2. **Integrate advanced and innovative technologies** like remote sensing, GIS, data analytics, and machine learning with in-situ measurements which enhances the ability to monitor trends, assess interventions, and support evidence-based decisions for sustainable wetland management and restoration.

36 Otero, M.M. et al. (2024) Policy analysis and policy demands for data, methods, and tools (Part B). Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

In this context, monitoring frameworks must balance the need for robust indicators that provide clear evidence of how coastal wetland restoration contributes to multiple policy objectives, with the imperative to avoid adding unnecessary administrative complexity. Indicators should be designed to demonstrate progress in a transparent and comparable way, while remaining practical for national and local authorities to implement within existing monitoring systems.

Support from RESTORE4Cs

A comprehensive analysis of end-user needs at the EU and national/regional levels for data, information systems, methods, and tools was conducted by the RESTORE4Cs project to help address and monitor policy targets for wetland restoration and climate change mitigation and adaptation objectives. As a result of this analysis, eight policy outcome indicators have been developed to evaluate the status, trends, and targets for coastal wetlands in alignment with EU policies (Table 4).

These indicators were selected to respond to key policy questions and are structured around five thematic areas: wetland extent change, ecosystem health condition, wetland connectivity, wetland ecosystem services, and ecosystem conversion. Each indicator description also specifies its links to existing policies such as the Habitats Directive, the WFD, and EU NRR.

In many EU countries, policy outcome indicators for wetland restoration are either absent or insufficiently defined. National stakeholders are therefore encouraged to determine which of these indicators to apply, taking into account country-specific circumstances, wetland-related needs and efforts already made in tracking progress on coastal wetland restoration and conservation. As a preparatory step for such decision, indicators currently in use at national level should be mapped, including the reporting metrics and spatial data layers applied to coastal wetlands. This mapping ensures that EU-level harmonisation is complemented by national and local precision, strengthening both comparability and relevance.

In addition to defining metrics for the different indicators, RESTORE4Cs has put in place spatial datasets available to measure several of these indicators in the EU and makes this information public available on the European Coastal Wetlands Interactive Platform. For instance, information is made available on the coastal wetland extent in protected areas for Natura 2000 sites. RESTORE4Cs has also progressed measurement of the indicator "Potentially Restorable Wetlands", contributing to the indicator Coastal Wetland Restoration Rate. Results from these indicators can be filtered and displayed by country in the **Policy Progress tracking tool** on the European Coastal Wetlands Interactive Platform, offering both harmonised EU-wide insights and the flexibility for national authorities to refine monitoring with higher-resolution local data.

go to the ***interactive tool***

It is noted that the policy outcome indicators related to protected areas (e.g., extension of coastal wetlands protected and strictly protected) and climate change targets (e.g., GHG fluxes and vulnerability to climate-related risks) are particularly relevant, as they can be applied more universally across all EU countries.

To generate information for these indicators, the objective should be to draw on already available data sources, both in-situ monitoring and remote sensing datasets. In this way, the use of the proposed indicators should not create additional burden to competent authorities but help provide the evidence needed on how coastal wetlands restoration efforts contribute to biodiversity conservation, water management, and climate policy objectives.

Table 4: Policy outcome indicators and metrics proposed by RESTORE4Cs to build evidence and foster greater integration between national and EU policies to streamline reporting processes. Indicators should be disaggregated per country and EU level.

Policy Indicator Output	Metric title	Units	Description
Extension of Coastal Wetlands Protected and Strictly Protected 	Total Coastal Wetland Extent in Protected Areas and in Strict Protected Areas	Area Coverage (km²)	Percentage change on spatial cover of total coastal wetlands protected and strictly protected from total protected areas.
	Total Coastal Wetland Extent in Natura 2000 sites	Area Coverage (km²)	Extent of coastal wetlands within the Natura 2000 network.
	Total Coastal Wetland Extent designated as Ramsar and/in Natura 2000	Area Coverage (km²)	Total area of coastal wetlands designated as Ramsar sites within the Natura 2000 network.
	Total Coastal Wetland Protected as a Proportion of Coastal Wetlands	Percentage of area coverage (km²)	Extent of coastal wetlands protected within designated areas as a percentage of the total coastal wetland extent. It offers a measure of the overall conservation coverage of coastal wetlands.
Representativity of Coastal Wetland Habitats in Protected Areas 	Spatial Cover of Different Coastal Wetland Habitats in Protected Areas	Percentage of area coverage (km²)	Coastal wetland extent data by habitat type (e.g., salt marshes, mudflats).
	Individual Coastal Wetland Habitat Extent in Natura 2000	Area Coverage (km²)	Specific coastal wetland habitat types within the Natura 2000 network.
Improved Coastal Wetland Health 	Coastal Wetland Knowledge	Proportion of data available where habitat condition is known.	Measures the extent of knowledge available regarding the habitat condition of coastal wetlands, as outlined in Annex I of the NRR.
	Coastal Wetland Habitat Condition	Percentage change in good condition of different coastal wetland habitats	Measures changes in the quality of various coastal wetland habitats (Annex I of Habitats Directive and those in Annexes I, II, IV and V of the Habitats Directive and the EU NRR) over time and per each biogeographic region. It includes factors such as vegetation health, soil quality, and water clarity.
	Coastal Wetland Biodiversity (Species) Condition	Percentage change in good condition of different coastal wetland species	Tracks changes in the condition of species diversity and abundance (referred to in Annexes II, IV and V to Directive 92/43/EEC and of the species covered by Directive 2009/147/EC.) within different coastal wetland habitats.

Improved Coastal Wetland Health 	Deterioration Status	Area Coverage (km²) of deteriorated coastal wetlands Level of deterioration of different types Area Coverage (km²) of drained Coastal Wetlands and organic soils	Assesses the extension of total deterioration of coastal wetlands based on parameters such as pollution levels, Invasive species presence, drainage, and physical alterations.
	Risk Posed by Invasive Species	Area Coverage (km²) Population size Number of Invasive species	Assesses the size of populations and extension risk posed by invasive species (species strictly regulated + species of concern) to natural coastal wetland ecosystems.
Coastal Wetland Restoration Rate 	Hydrological Connectivity	Km of free-flowing rivers connected to coastal wetlands being restored	Evaluates changes in water flow patterns and connectivity between wetland areas
	Surface and Groundwater Restoration	Threshold values	Based on the WFD, it examines trends on water restoration efforts from multiple dimensions of surface and groundwater status, particularly quality and quantitative.
	Pollutant Reduction Effectiveness	Percentage decrease in concentrations of key pollutants	Evaluates the trend reductions in pollutant levels to meet the targets set by the Zero Pollution Action Plan, the MSFD and the WFD.
	Barrier Impact Index	% change in natural water flow patterns due to the elimination of barriers	Assesses the impact of physical barriers (e.g., roads, dams, levees, dikes, ports) on the ecological connectivity, hydrological flow (marine and coastal).
	Restoration Potential	National plans that prioritize coastal wetland restoration Area Coverage (km²) of potential restored habitats from the proportion deteriorated	Assesses efforts to help identify and prioritise areas for coastal wetland restoration.
	Restoration Progress	Area Coverage (km²) of habitats of coastal wetlands restored and under restoration Number of Countries Area Coverage (km²) of coastal wetlands with restored drainage systems	Percentage change in condition or extent specifically attributable to coastal wetland areas under active restoration or restored from the percentage of area deteriorated. Habitats refers to habitat types listed in Annex I and II to the Habitats Directive and Annex II to the EU NRR.
Vulnerability to Climate-Related and Natural Disasters 	Coastal Wetland Vulnerability	Index score	Assesses the vulnerability of coastal wetlands to various environmental stressors, particularly climate change impacts such as sea-level rise, storm surge, and increased frequency of extreme weather events.

GHG Emissions and Abatement from Coastal Wetland Land Use Conversion and Restoration 	Land Use Conversion Area	Percentage Change of converted coastal wetland area	Proportion at which coastal wetlands are converted to other land uses over time (from reference reporting period) to assess the effectiveness of land use policies to conserve natural carbon sinks such as wetlands.
	Extended Coastal Wetland Habitat Loss/Gain Ratio	Area Coverage (km^2) of total coastal wetlands	Compares the area of wetland habitats lost to development or other uses against the area gained through conservation and restoration activities.
	GHG Emissions and Removals from Land Converted Wetlands	GHG emissions and removals /ha/year following wetland conversion	Tracks losses and emissions of CO_2, methane, and nitrous oxide resulting from the conversion of coastal wetlands to other land uses.
	GHG from Coastal Wetland Restoration	GHG emissions/ha/ year following wetland restoration	Tracks the net balance of CO_2, methane, and nitrous oxide from coastal wetland restoration.
Share of Utilised Agricultural Area (UAA) under Common Agricultural Policy (CAP)– Supported Commitments in Coastal Wetlands 	Share of Agricultural Area in Coastal Wetlands	Ha of land used for agriculture within coastal wetlands. Ha of UAA within coastal wetlands that are managed under CAP-supported initiatives.	Tracks the adoption of sustainable agricultural practices and helps evaluate the impact of CAP policies on emission reduction and carbon storage.
	Agricultural Carbon Seques-tration and GHG Reduction Index in Coastal Wetlands	Carbon Sequestration Rate and GHG emissions/ ha/year from CAP Agriculture land in coastal wetlands	Tracks the adoption of agriculture lands to reduce emissions or to maintain or enhance carbon storage on agricultural land in coastal wetlands.
Overall Funding Sources for Coastal Wetlands 	Coastal Wetland Funding	Euros per reporting period	Evaluates the overall funding landscape for coastal wetlands, assesses the availability, from various sources, including government agencies, non-governmental organisations, international bodies, and private sector contribution.

Source: RESTORE4Cs Policy Brief No. 6: European Coastal Wetland Indicators: A proposal for monitoring policy processes across space and time (2025).

Key recommendations

- Integrate **policy outcome indicators into national wetland strategies** to systematically monitor progress in wetland restoration and condition. Authorities are encouraged to determine which of the indicators proposed by RESTORE4Cs are most relevant, taking into account country-specific circumstances, wetland-related needs, and the efforts already made to track progress in restoration and conservation.
- **Map existing indicators currently used at national level**, including reporting metrics and spatial data layers, to establish a baseline and ensure alignment with EU-wide approaches.
- **Optimise and refine indicators** by combining those already in use with the policy outcome indicators developed under RESTORE4Cs, to develop a set of more clear, measurable indicators and metrics to assess changes in wetland ecological status, resilience, and contributions to climate and biodiversity policy targets.
- **Leverage existing data sources**, both in-situ monitoring and remote sensing datasets, and **enhance them with advanced technologies** such as data analytics and remote sensing to strengthen information on policy outcome indicators.
- Develop guidance at national level for **integrating monitoring streams across different policies**, ensuring coherence, comparability, and reduced administrative complexity.
- Ensure indicators contribute directly to **national restoration progress reports** (under the NRR) and to **global reporting obligations** (e.g., Ramsar), linking national actions with international commitments.

Where to find more information

- **RESTORE4Cs Policy Brief No. 6:** European Coastal Wetland Indicators: A proposal for monitoring policy processes across space and time (2025)[37].
- **RESTORE4Cs European Coastal Wetlands Interactive Platform:** Policy Progress tracking tool.

37 Authors: Otero, M. M., Abdul Malak, D., Sanchez A., Schröder, C., Kampa, E., Bueb B., Elkina, E., Guelmami, A., Camacho, A., Marangui, C., Lillebø, A.

3.3.2 Map potentially restorable wetlands

→ In which areas have wetlands been lost through past land-use conversion?

→ Which lost wetlands have the highest potential for regeneration and re-creation of wetland habitats and hydrological processes?

Identifying candidate sites for wetland habitats regeneration is essential for developing a restoration strategy that is both ecologically meaningful and compliant with the requirements of the EU NRR. Article 4(8) of the EU NRR asks Member States to identify the most suitable areas for restoration of Annex I coastal habitat types using the best available knowledge and latest scientific evidence. A systematic approach is therefore essential to identify:

- Where wetlands historically existed,
- Where degraded wetland habitats can be restored,
- Where restoration is biophysically feasible today,
- Where restoration measures are ecologically relevant, and
- Where the local governance context facilitates the implementation of wetland restoration actions.

Support from RESTORE4Cs

go to the ***interactive toolbox***

RESTORE4Cs developed a harmonised, science-based and spatially explicit methodology that supports this task. It enables countries to identify and delineate wetland ecosystems using harmonised maps of **Potential Wetland Areas (PWA)**. By overlaying these PWA baselines with current land-use and land-cover datasets, the **RESTORE4Cs Spatial Decision-Support Toolbox** distinguishes where wetlands have been drained, reclaimed or transformed. It then evaluates their potential for regeneration based on hydrological feasibility, land-use reversibility, soil and topographic conditions, and the estimated effort needed to recover wetland functions. This results in a delineation of **Potentially Restorable Wetlands (PRW)**, representing areas where wetland habitat and hydrological processes could be restored. This combined assessment is essential for determining restoration priorities and ensuring consistency across national and EU reporting systems.

The RESTORE4Cs approach applies a four-step spatial workflow that progressively narrows down restoration opportunities by examining: (1) the coastal area of interest, (2) the historical potential for wetlands, (3) areas where wetlands have been lost but are restorable, and (4) existing wetlands that persist but require ecological rehabilitation.

Identify Potential Wetland Areas to establish historical and biophysical wetland extent

The first step consists of identifying PWA, which represent zones that possess the biophysical characteristics prone of supporting wetland ecosystems, regardless of whether wetland habitats are currently present (see Figure 11). PWAs are derived from harmonised hydro-topogra-

phic modelling using the Copernicus Digital Elevation Model (DEM) COP30 (with 30 m of spatial resolution) and environmental metrics including surface water regimes, Topographic Wetness Index, floodplain delineation, slope, evapotranspiration and soil features. Through this approach, PWAs reconstruct the potential or historical extent of wetlands and provide a baseline against which wetland loss and restoration potential can be assessed.

A key feature of the PWA product is that it is expressed as a continuous probability surface, allowing users to understand not only whether an area could support the occurrence of wetland habitats, but how likely it is to do so under natural conditions. The PWA probability values range from 0 "Very low probability" to 1 "Very high probability", reflecting the gradient of biophysical suitability across the landscape. This continuous representation gives planners and analysts the flexibility to define thresholds appropriate to their ecological, hydrological or policy context.

In addition to the continuous layer, classified PWA rasters were produced to support easier interpretation and visualisation. These classify suitability into five probability classes: "1. Very low probability", "2. Low probability", "3. Medium probability", "High probability", and "5. Very high probability".

Together, the continuous and classified PWA products provide authorities with a robust starting point for restoration planning. They make it possible to quantify the historical footprint of wetlands, identify which areas have been converted to other land uses, and understand where ecological and hydrological conditions would naturally favour wetland restoration. As such, PWAs form the foundational spatial layer for defining restoration potential and for structuring the subsequent assessment steps of the RESTORE4Cs methodology.

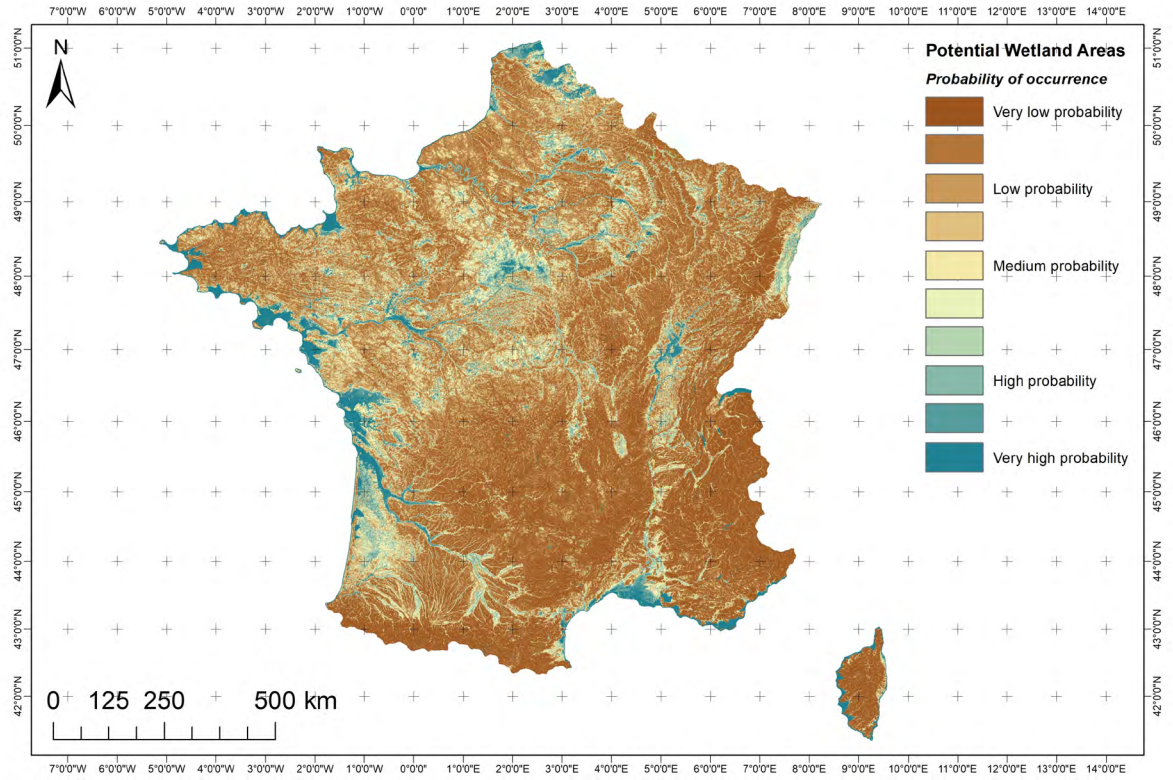


Figure 11: Example from France of mapped Potential Wetland Areas (PWA).

Source: Spatial Decision-Support Toolbox on the RESTORE4Cs European Coastal Wetlands Interactive Platform.

Map Potentially Restorable Wetlands based on land-use conversion and restoration feasibility

Building on the PWA baseline, the second step focuses on identifying PRW; areas where wetlands once existed, according to the biophysical potential mapped in the previous step but have since been converted to other land uses while still retaining feasible conditions for restoration. The purpose of the PRW layer is to evaluate where ecological regeneration could realistically take place by reconnecting hydrological processes, re-establishing wetland habitats, and reducing or removing anthropogenic pressures.

The PRW assessment examines how historical land-use change has transformed former wetland landscapes and evaluates whether these areas could be brought back into a functioning wetland state. This analysis considers hydrological constraints, topographic suitability, soil properties and broader landscape morphology – metrics already embedded within the PWA modelling framework – as well as, critically, the reversibility of the current land use. The reversibility scores attributed to the Land-Use/Land-Cover (LULC) classes are defined based on expert judgement provided by wetland restoration specialists, reflecting how different LULC conversions influence the feasibility and expected effort of wetland regeneration efforts.

Similar to the continuous PWA surface, the PRW layer is modelled as a national raster ranging from 0 to 1 (see Figure 12). Values close to 0 indicate areas least suitable for restoring previously lost wetlands, either because restoration is biophysically unrealistic or because the area was never a wetland historically. Values equal to 1 represent territories where wetlands still exist today or areas where the conditions for restoration remain highly favourable. Intermediate values capture a gradient of restoration feasibility, with pixels near 1 signalling very high suitability for the regeneration of wetland habitats, provided appropriate restoration actions are undertaken. This continuous representation allows for a more refined interpretation of restoration potential and can be adapted to national or local planning needs.

In practice, different land uses are interpreted according to the level of effort required to recover natural hydrological and ecological processes. Drained agricultural fields, for instance, may be restored relatively easily through rewetting or the removal of drainage infrastructure, whereas landscapes dominated by transport corridors, industrial zones or dense urban areas often require substantial intervention, or may not be restorable at all. By integrating these expert-derived reversibility scores with the PWA data, the PRW layer offers a nuanced and realistic representation of restoration feasibility across the landscape.

A note of caution is essential when interpreting PRW outputs, as their accuracy depends significantly on the quality of input datasets, particularly the LULC maps and the wetland extent layers used to determine which parts of the PWA have been converted. In the PRW products developed so far within RESTORE4Cs, CORINE Land Cover 2018 (CLC 2018) was used for LULC, while wetland extent information relied on the Copernicus Wetlands Extent Map, and the European Wetland Map produced by the ALFA-Wetland and WET Horizons projects[38,39]. These datasets

38 ALFAwetlands. (2025). ALFAwetlands – wetland restoration for the future. ALFAwetlands project. Available at: https://alfawetlands.eu/.

39 WET HORIZONS. (2025). About WET HORIZONS. WET HORIZONS project. Available at: https://www.wethorizons.eu/about/.

are suitable for a first pan-European overview. However, they do not always capture fine-scale hydrological and ecological patterns relevant for national-level planning. Consequently, PRW layers could be substantially improved wherever more detailed national and/or local datasets exist or become available, including higher-resolution LULC maps and updated wetland inventories. Countries that can integrate more accurate national data will be able to generate PRW outputs that better reflect the true feasibility and potential impact of restoration interventions in their territory.

Despite these limitations, the PRW layer offers a powerful and actionable spatial foundation for identifying wetland regeneration opportunities. It highlights where restoration could re-establish natural hydrology, reconnect fragmented floodplains, recover carbon-rich soils, or reactivate ecological corridors. **Across Europe, PRW analyses commonly point to drained floodplains, agricultural deltas, embanked marshlands and reclaimed coastal plains as key candidates for restoration:** areas where ecological and climate benefits can be particularlavy significant.

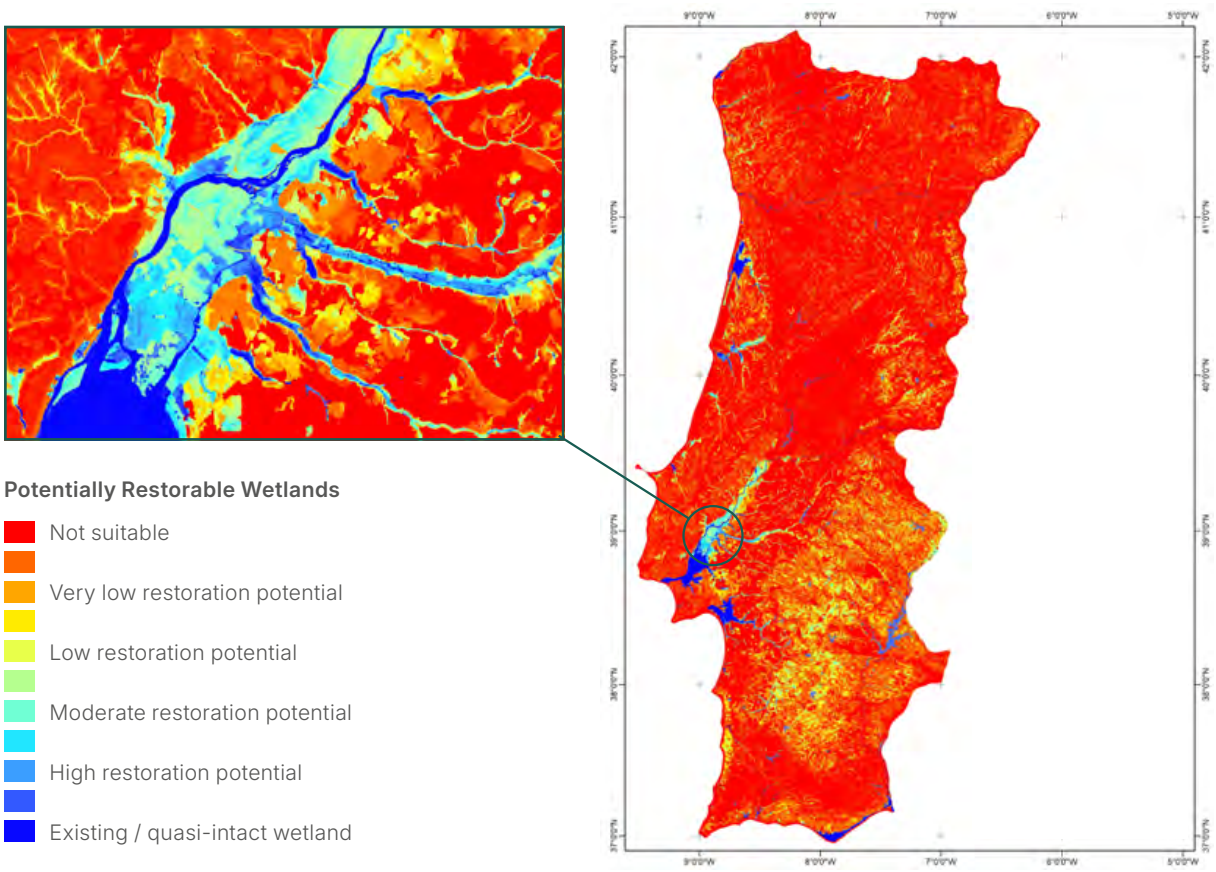


Figure 12: Example from Portugal of mapped Potentially Restorable Wetlands (PRW), with a zoom on the Tejo coastal floodplain.

Source: Spatial Decision-Support Toolbox on the RESTORE4Cs European Coastal Wetlands Interactive Platform.

Define the Coastal Mask (Biophysical Feasibility Zone)

The RESTORE4Cs coastal mask is based on:

- Elevation thresholds derived from high-resolution DEMs to identify the low-lying fringe where coastal wetlands are ecologically possible,
- Hydrological indicators (slope, Topographic Wetness Index, flow accumulation),
- Flooding patterns and long-term water occurrence from Global Surface Water,
- Proximity to marine influence (e.g., marine aerosol distance).

RESTORE4Cs identifies the coastal zone where wetlands could be restored. This coastal domain forms the spatial boundary for the next steps. Figure 13 shows the methodology used to delineate the coastal zone by combining elevation thresholds, storm and flooding frequency, and marine aerosol influence.

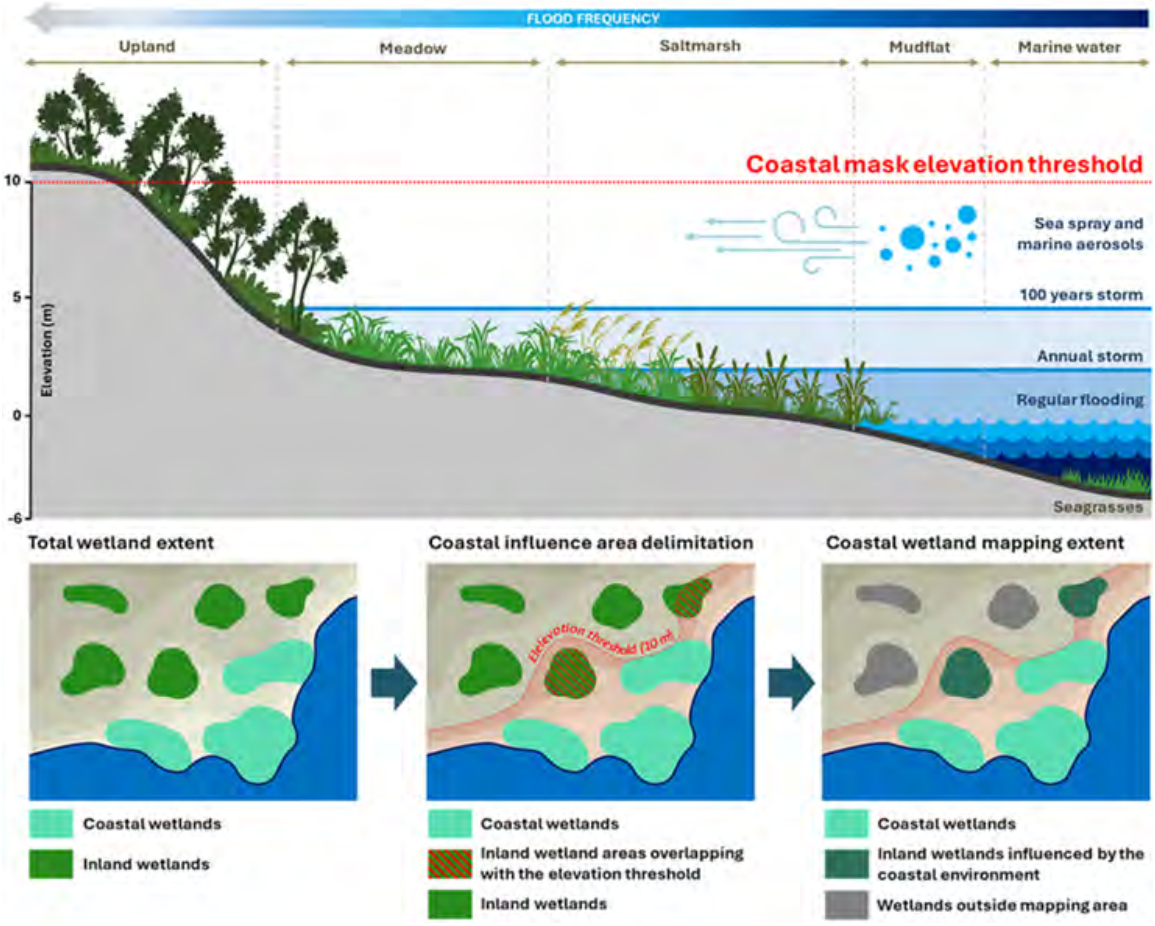


Figure 13: Methodological approach to determine the potential coastal wetland areas.

Source: RESTORE4Cs Policy Brief No. 8: Advancing a coherent framework for assessing European coastal wetland condition (2025). Note: The upper panel shows how different coastal ecosystems (upland to seagrasses) align along an elevation and hydrodynamic gradient, with a defined elevation threshold marking the upper limit of coastal influence. The lower panels demonstrate the operational steps: starting from the total wetland extent, applying the coastal influence zone based on the elevation mask, and deriving the final coastal wetland mapping extent by isolating wetland areas influenced by coastal processes.

The RESTORE4Cs' coastal wetland mapping mask is illustrated in Figure 14, which maps all European areas where coastal wetlands are biophysically possible.

Legend: Costal wetland mapping mask

Figure 14: Map of all biophysically possible areas for coastal wetlands based on the coastal wetland mapping approach developed by RESTORE4Cs.

Source: University of Malaga.

Key recommendations

- **Integrate Potential Wetland Areas (PWA) and Potentially Restorable Wetlands (PRW) maps into national restoration planning** to ensure that the identification of restoration opportunities is grounded in harmonised, EU-wide datasets and consistent biophysical criteria.
- Use the PRW restoration-effort classes to **target areas where restoration is both feasible and likely to deliver high ecological and climate benefits**, prioritising areas with strong potential for hydrological reconnection and cost-effective intervention.
- Use **PRW outputs** as part of the evidence base demonstrating **how suitable areas for restoring coastal habitats are identified** to comply with Article 4(8) of the EU NRR which asks Member States to identify most suitable areas for restoration of Annex I habitats.

- → Refine PRW-based assessments with **national and/or local LULC datasets to validate feasibility and improve accuracy**, especially in regions where EU-scale data are insufficient.
- → Address data gaps highlighted by PRW analyses through **targeted field surveys or complementary national monitoring**, particularly in areas where remote-sensing products fail to capture fine-scale wetland dynamics.
- → Promote transparency and cross-sector collaboration by making **national adaptations of PRW and PWA layers accessible to relevant authorities**, supporting integrated restoration planning across biodiversity, climate, water and land-use sectors.

Where to find more information

- **RESTORE4Cs Deliverable:** Potential areas for wetlands restoration assessment, including datasets (2025). Available at: https://www.restore4cs.eu/about/workplan/ (under WP6 – Upscaling and integration for assessment of the status and restoration potential of wetlands in Europe).
- **RESTORE4Cs European Coastal Wetlands Interactive Platform:** Spatial Decision Support Toolbox.

3.3.3 Prioritise coastal wetland sites with highest potential impact on climate mitigation and other co-benefits

- → Which coastal wetlands to restore and why?
- → What criteria can be used to prioritise wetland sites for restoration?
- → Where can coastal wetland restoration maximise co-benefits for climate change mitigation, biodiversity conservation and socio-economic resilience?

Not all restoration opportunities deliver the same level of climate change mitigation potential or generate comparable ecological and socio-economic benefits. To make best use of available resources, planning authorities need to identify and prioritise coastal wetland sites where restoration can achieve the greatest overall impact.

Prioritisation is essential to ensure that restoration efforts target areas with the highest combined potential for ecological recovery and climate benefit, while also aligning with national restoration targets and EU-level commitments under the EU NRR, the Biodiversity Strategy for 2030 and the LULUCF Regulation. By identifying where restoration can deliver multiple benefits most effectively, authorities can design restoration pathways that maximise returns on investment and foster long-term resilience.

This section of the roadmap supports authorities in evaluating and ranking candidate restoration sites with a particular focus on their potential contribution to climate change mitigation through carbon storage, avoided emissions and long-term sequestration. It also highlights wider co-benefits such as biodiversity support, improved ecological connectivity, water cycle regulation, coastal protection, and contributions to local cultural and livelihood values.

Support from RESTORE4Cs

go to the ***interactive toolbox***

The RESTORE4Cs project developed a **Spatial Decision-Support Toolbox** which is a geo-analytical platform designed to help users identify, evaluate and prioritise wetland restoration opportunities across European coastal areas. The Toolbox is an interactive online environment which enables users to visualise and explore restoration potential through maps, filters, statistics and comparative analyses. It supports both strategic planning and site-level scenario assessment, making it adaptable to multiple governance contexts, from EU-wide assessments to local co-design processes.

The **Spatial Decision-Support Toolbox** builds upon harmonised data from European land cover and biodiversity monitoring systems, and modelled indices of wetland function and restoration suitability. The Toolbox integrates spatially explicit environmental and socio-economic information to assess the restorability of degraded or converted wetland areas.

The Toolbox is structured in **two pillars** that capture both lost wetlands that could be regenerated and existing wetlands requiring ecological rehabilitation, therefore enabling a comprehensive understanding of restorability across European coastal landscapes (see Figure 15).

- **The first pillar** was elaborated under the previous roadmap step on delineating **PRW**, representing areas where wetland habitat and hydrological processes could be restored.

- **The second pillar** evaluates the condition and degradation of existing wetlands. Many coastal wetlands no longer function effectively due to hydrological alteration, nutrient loading, fragmentation or other anthropogenic-related pressures. The Toolbox integrates indicators of habitat condition, anthropogenic pressures, water dynamics and landscape context to help identifying where rehabilitation is needed. This includes areas where interventions such as tidal reconnection, rewetting, removal of drainage infrastructure or habitat enhancement could restore ecological integrity and ecosystem service provision.

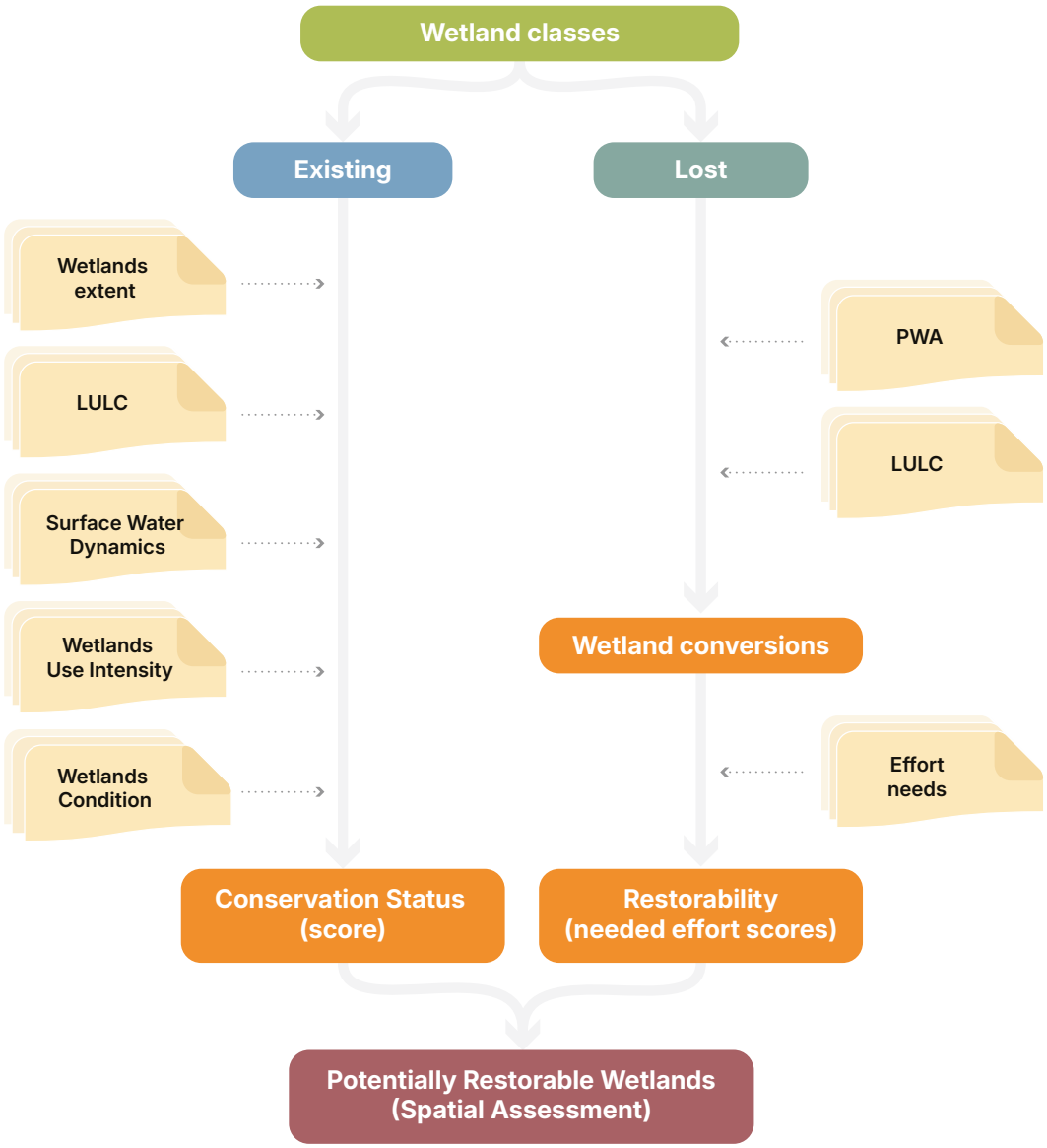


Figure 15: Two pillars underpinning the RESTORE4Cs Spatial Decision-Support Toolbox.
Source: RESTORE4Cs Policy Brief: Advancing Evidence-Based Prioritisation for Coastal Wetland Restoration in Europe: The RESTORE4Cs Spatial Decision-Support Toolbox (2025).

These two analytical pillars are combined to create a layered and integrated understanding of restorability potential. The Toolbox further incorporates additional spatial layers, including protection status, connectivity with Natura 2000 and Key Biodiversity Areas, exposure to sea-level rise and coastal erosion, carbon storage and sequestration potential, and socio-economic considerations, to evaluate the strategic relevance of restoring each area.

The final output consists of **spatially explicit priority maps that identify where restoration of coastal wetlands can achieve the greatest benefits** for biodiversity, climate change mitigation, water cycle regulation, and socio-economic resilience. The resulting maps and statistics can be explored at both pan-European and national scales, supporting transparent, spatially explicit prioritisation of restoration actions.

Through the interactive interface of the toolbox, users can filter and visualise the results, examine underlying datasets, adjust weighting criteria, explore alternative prioritisation pathways, and visualise how selected restoration strategies shift across space. This flexibility allows the Toolbox to support iterative, evidence-based decision-making from national planning to site-specific implementation.

Key recommendations

- → Use the Spatial Decision-Support Toolbox **as a visual exploration platform and a strategic instrument** to guide restoration planning and implementation.
- → Use the Spatial Decision-Support Toolbox to **identify high-impact restoration zones**, where ecological, climatic and socio-economic co-benefits align.
- → Use S**patial Decision-Support Toolbox outputs in the development of National Restoration Plans**, ensuring restoration priorities are grounded in spatially explicit, evidence-based assessments.
- → Integrate additional **information from the field to target the "real" needs** in terms of wetlands restoration.
- → Facilitate **cooperation with landowners and local authorities in high-priority area**s where restoration of coastal wetlands can achieve the greatest benefits, as restoration feasibility often depends on governance and land-tenure conditions.

Where to find more information

- **RESTORE4Cs European Coastal Wetlands Interactive Platform:** Spatial Decision-Support Toolbox.
- **RESTORE4Cs Policy Brief No. 10:** Advancing Evidence-Based Prioritisation for Coastal Wetland Restoration in Europe: The RESTORE4Cs Spatial Decision-Support Toolbox (2025)[40].

40 Authors: Guelmami, A.

3.4 Plan restoration activities

3.4.1 Scope suitable restoration techniques to increase GHG mitigation capacity of coastal wetlands

→ Which types of restoration actions in coastal wetlands can increase carbon sequestration and reduce GHG emissions by lowering pressures and reducing impacts?

The selection of suitable restoration actions for specific restoration sites should rely on knowledge and scientific evidence on the effectiveness of restoration actions in improving biodiversity, enhancing climate change mitigation capacity, and reducing disaster risks. The selection of restoration actions should also consider site-specific conditions, including hydrology, soil, flora, and fauna as well as existing anthropogenic alterations, including the wetland itself and its whole surface catchment and, eventually, its connections to groundwaters[41]. A scientific assessment of these factors and impacts which different restoration actions have on them allows to inform restoration decisions.

Although it is recognised that restoring degraded coastal wetlands can improve their carbon storage capacity[42], scientific literature also shows high variability in the impact of different restoration actions on carbon stocks and CO_2, CH_4 and N_2O fluxes[43], without providing general patterns of trends on coastal wetlands.

Camargue, France
Source: © RESTORE4Cs, University of Salento / LIFEWatch ERIC

41 Camacho, A. et al. (2019). *Management and protection of Mediterranean groundwater-related coastal wetlands and their services.* United Nations Educational, Scientific and Cultural Organization (UNESCO). Paris, 137 pp.

42 Morant, D. et al. (2020). *Carbon metabolic rates and GHG emissions in different wetland types of the Ebro Delta.* PLoS ONE 15(4): e0231713. https://doi.org/10.1371/journal.pone.0231713.

43 Misteli, B. et al. (2023). *Case Pilots overview and context setting.* Deliverable. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP4 – Climate mitigation services and C and GHG processes in wetlands).

Support from RESTORE4Cs

The RESTORE4Cs project aimed to improve scientific knowledge on the effects of coastal wetland restoration on their GHG mitigation capacity. Restoration outcomes can result from active or passive actions. RESTORE4Cs scientific work focused on "active restoration" practices which aim to eliminate the source of degradation and disturbance of an ecosystem and includes measures to accelerate recovery.

The following are main results and conclusions of the scientific literature and analysis of pilot restorations sites of RESTORE4Cs[44,45,46,47]:

- Restoration actions for coastal wetlands were grouped and the effects of each group of actions on carbon balance and GHG mitigation capacity have been described (see Table 5).
- The restoration actions most effective for GHG abatement were identified using statistical analysis. Most groups of assessed restoration actions generally **show a positive response to climate regulation** including both carbon storage and reduction of the GHG warming potential. Restoring coastal wetlands or preserving them in a natural state is beneficial for climate change mitigation. Most coastal wetlands altered by human intervention are net GHG emitters, while most of the preserved coastal wetlands are net GHG absorbers.
- Different restoration actions deliver different results depending on the type of existing alterations and the type of wetland. Wetlands behave differently due to their different ecological characteristics such as salinity (salinity is important for GHG fluxes with saline wetlands producing less methane compared to freshwater wetlands).
- Restoration actions that **restore natural hydrology, morphology, vegetation, water quality or land use in the catchment** offer higher potential for GHG reductions and/or carbon storage.
- Methane is a GHG much more potent than carbon dioxide at trapping heat in the atmosphere. **Coastal wetland restoration can make a significant contribution to reducing methane fluxes.** Beneficial restoration actions to reduce methane emissions are the restoration of vegetation and the removal and reuse (e.g. as agricultural soil amendment) of the top sediment which is often polluted with organic material. It is noted that the restoration of vegetation can at first lead to slightly higher methane emissions (first 1–2 years after restoration), by transporting methane from the sediment to the atmosphere.
- Due to the great variety of coastal ecosystems, their ecological characteristics, and the multiple impacts to which they are subjected, **site-specific analyses** are needed to select suitable restoration actions and evaluate the response of the wetland.

44 Morant, D. et al. (2025). *Report on the key wetland restoration actions.* Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

45 Morant, D. et al. (2020). *Carbon metabolic rates and GHG emissions in different wetland types of the Ebro Delta.* PLoS ONE 15(4): e0231713. https://doi.org/10.1371/journal.pone.0231713.

46 Rochera, C. et al. (2025). *Linking carbon fluxes to flooding gradients in sediments of Mediterranean wetlands.* ACS ES&T Water 5(6): 2882-2890. https://doi.org/10.1021/acsestwater.4c00940.

47 Misteli, B. et al. (2025, November 16). *Coastal wetland restoration and greenhouse gas pathways: A global meta-analysis [Preprint].* EarthArXiv. https://doi.org/10.31223/X51B39.

Table 5: Coastal wetland restoration actions and climate change mitigation benefits.

Groups of restoration actions for coastal wetlands	Description of restoration actions	Climate change mitigation benefits
Water quality restoration	Reduces nutrient and pollutant inflows by implementing erosion controls, reducing runoff, constructing wetland treatment systems, and introducing watershed management of agricultural and urban activities to combat eutrophication and support ecosystem health.	Improved water quality reduces eutrophication thus increasing redox potential and dropping methane emissions, and supports the growth of native vegetation, which sequesters carbon in biomass and soils.
Hydrological restoration	Re-establishing natural water regimes, water levels and hydroperiods through actions like rewetting, water level correction, reconnecting coastal wetlands with tidal flows, diverting waterways, pond creation, restoring groundwater flow, and seasonal water management.	Restoring an appropriate natural hydrological structure helps reduce GHG emissions. Indirectly, water recovery also promotes the establishment of plant communities, which further enhances carbon sequestration capacity. Reconnecting coastal wetlands with tidal flows restores natural sediment deposition and carbon storage while reducing methane emissions through sulphate-reducing processes.
Morphological restoration	Recovering geomorphological structures, sediment dredging, creating marsh terraces, restoring natural coastal features like dunes restoration, and rebuilding tidal marshes and mudflats to restore sedimentation processes and stabilise ecosystems.	This approach is typically applied in the most extreme cases, where the wetland's structure has been completely lost.
Hydro-morphological restoration	Combines hydrology and geomorphology to address wetland degradation comprehensively.	Hydromorphological restoration actions are often combined, which can accelerate improvements in carbon storage capacity and/or reductions in GHG emissions. However, in the short term, such actions may increase methane emissions, driven by degradative processes and anoxic conditions after re-flooding. These effects are generally offset in the medium to long term, as ecosystem functioning stabilises and achieves a more favourable balance.
Vegetation restoration	Planting native species, both submerged and emergent, or reforesting wetland forests, restoring salt marshes or tidal wetlands.	By implementing actions such as planting native vegetation, reforesting wetland forests, and managing invasive species, degraded wetlands can be transformed into resilient ecosystems capable of mitigating climate change. On the other hand, the effects of these plants on GHG such as methane are more complex, being able both to favour these fluxes through enzymatic and metabolic activity in anoxic zones and acting as pipes driving GHG to the atmosphere, and to reduce them through oxygenation of the soil. In this case, the type of community and the ecological conditions in which they develop needs studying in detail.
Land use change (catchment-based restoration)	Transforms areas previously drained or degraded by agriculture or urban development into functioning healthy wetlands, often through policy and planning interventions. It includes rewetting drained wetlands, conversion of agricultural lands, urban wetland restoration, reforestation of wetland forests, sediment and soil recovery, and incorporation of buffer zones.	Can involve either full hydromorphological restoration or passive recovery. In the case of active restoration, the process enhances both the structure and function of the wetland, enabling it to regain its carbon sequestration capacity and reduce GHG emissions. This is particularly important for carbon stored in sediments over decades, which might otherwise be released due to prior disturbances.

Invasive alien species removal	Manual and mechanical removal of invasive plants and animals, introduction of biological control agents, implementing hydrological management, restoring native vegetation after removal, ensuring regional coordination and monitoring.	Removing invasive species allows native vegetation to recover, enhancing organic carbon accumulation in biomass and soils. Some invasive plants, such as reed canary grass or water hyacinth, can create anoxic conditions that promote methane production. Their removal helps restore balanced gas emissions.

Source: Own illustration based on the RESTORE4Cs Deliverable: Report on the key wetland restoration actions (2025).

Key recommendations

- → **Carry out site-specific analyses** to evaluate how each wetland and its components respond to proposed restoration actions and to decide when, where and how much to restore. There is no single recipe for restoring coastal wetlands. Restoration actions need to be specific to the type of wetland.
- → Coastal wetland restoration actions which **restore natural hydrology, morphology, vegetation, water quality or land use in the catchment** offer higher potential for GHG reductions and/or carbon storage.
- → The aim of coastal wetland restoration actions **includes co-benefits** and not only climate benefits at the expense of biodiversity. For instance, water quality improvement measures are beneficial for reducing methane release and for reducing pollution harmful to biota.
- → When selecting restoration actions, focus on **long-term impacts** but also evaluate potential **short- and medium-term trade-offs**, such as temporarily increased methane emissions resulting from the restoration of vegetation or anoxic conditions created by re-flooding.
- → Implement **robust multi-GHG monitoring** to detect and accurately quantify potential climatic benefits of coastal wetland restoration actions.

Where to find more information

- **RESTORE4Cs Deliverable:** Report on the key wetland restoration actions (2025)[48]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).
- **RESTORE4Cs Policy Brief No. 1:** How can coastal wetlands help achieve EU climate goals? (2024)[49].
- **RESTORE4Cs Policy Brief No. 9:** How can coastal wetland restoration mitigate climate change? What we know and what is still unclear (2025)[50].

48 Authors: Morant, D., Picazo, A., Rochera, C., Camacho, A., Cabrera, M., Attermeyer, K.
49 Authors: Otero, M., Camacho, A., Abdul Malak, D., Kampa, E., Scheid, A., Elkina, E.
50 Authors: Misteli, B., Attermeyer, K., Rochera, C., Lilebø, A., Camacho, A.

3.4.2 Assess benefits and costs of restoration actions for climate change mitigation

- What are the most cost-effective wetland restoration actions for climate change mitigation?
- How are different wetland restoration options perceived across multiple benefits (social, environmental, economic) in a given context?
- Which restoration actions are most socially acceptable in a given context?

Restoring coastal wetlands is a multidimensional planning challenge involving trade-offs between ecological, social, and economic priorities. Restoration actions can yield substantial benefits, such as carbon sequestration, biodiversity recovery and flood regulation. However, they also come with costs, namely financial, social, and sometimes political. To be successful, restoration planning must evaluate both the cost-effectiveness of interventions and their social acceptability. The latter is necessary to reflect the local needs and values, ensure support at the level where implementation and maintenance efforts take place. Restoration scenarios that ignore local preferences or undervalue societal co-benefits risk resistance, failure, or unintended harm. For this reason, transparent, evidence-based evaluation of benefits, costs, and stakeholder values is essential to ensure long-term impact, sustainability and legitimacy of restoration actions.

Support from RESTORE4Cs

Costs and benefits of wetland restoration actions can be estimated using various methods, depending on the specific purpose and use cases. The RESTORE4Cs project proposes the following approaches summarised in Table 6.

Table 6: RESTORE4Cs contributions to assessing costs and benefits of coastal wetland restoration.

Tool/Method	Use Case	Type of Support
Abatement Cost Curves (ACC)	Climate change mitigation planning	Identifies cost-efficient restoration
Multi-Criteria Analysis (MCA)	Site-specific scenario ranking	Informs trade-offs and social acceptance
Stakeholder Workshops	Participatory planning processes	Incorporates local values into decisions
Financing Inventory (see next section)	Sustainable funding of restoration	Links policy instruments to needs

Abatement Cost Curve (ACC) Methodology

In RESTORE4Cs, the ACC method was employed to compare the cost-effectiveness of wetland restoration pathways in reducing GHG emissions. These analyses quantify €/tCO_2eq (cost per CO_2 equivalents) or €/tCO_2 (cost per net CO_2) for restoration types such as peatland rewetting, flooded land creation, or maintaining existing wetlands.

In decision-making, ACC methodology can be used to compare different restoration options in terms of their relative costs to deliver outcomes and identify low-cost, high-impact wetland restoration actions for climate change mitigation funding or carbon offset schemes. For instance, converting degraded land into wetlands (particularly rewetting peatlands) was found to be more cost-effective (as low as €3/tCO_2) than maintaining existing ones (see Figure 16). It is noted that this conclusion is based on general data rather than site-specific inputs from the RESTORE4Cs project. It is further noted that maintenance and stewardship remain key aspects to ensure that degradation of wetlands does not lead to additional GHG emissions.

Figure 16: Cost-effectiveness time series for wetland management pathways (2000 – 2021).

Source: RESTORE4Cs Deliverable: Report on cost/benefit analysis of wetland restoration options and on financing tools (2025).

Risks and uncertainties associated with ACC method:

- The ACC analysis applied in RESTORE4Cs focused on other wetland restoration actions beyond coastal wetlands. The choice of the main metric (CO_2eq or net CO_2) is determinant and should consider potential trade-offs. When considering climate change mitigation, GHG emissions (tCO_2eq) allow to have a broader perspective (accounting for CO_2 fluxes & methane) to limit risks of trade-offs.
- The ACC relies on cost and emission estimates that may vary regionally. Lack of site-specific data can limit reliability.
- To promote the maintenance of existing wetlands, other metrics and approaches are needed including assessment of co-benefits (e.g. via MCA), as cost-effectiveness analysis alone based on current metrics and data available in literature is not suitable for this goal.

Multi-Criteria Analysis (MCA) framework and stakeholder workshops

RESTORE4Cs designed and applied a participatory MCA framework to assess stakeholders' preferences for multiple restoration options in six case pilot sites for coastal wetland restoration, integrating ecological, socio-economic, and socio-cultural indicators. Local stakeholders weighed criteria (preliminary short-listed by selected experts as relevant for coastal wetlands) according to their perceived importance in the wetland restoration decision-making process. Scenario performance was evaluated using site-specific data, leading to the identification of preferred restoration pathways according to a combination of criteria for each site.

Based on the MCA conducted in the RESTORE4Cs project, the following drivers of social acceptability were identified as the most relevant and frequently mentioned: **contextual factors, primarily local economic interests, as well as values, risks, and perceived societal and environmental impacts**. These drivers should be taken into account as relevant for conducting economic evaluation of coastal wetland restoration activities in other regions.

The MCA framework can be used in designing participatory planning workshops with local stakeholders. It supports decision-making by helping prioritise projects that deliver multiple and transversal co-benefits aligned with local values and environmental, social, economic and cultural relevant factors. Ensuring balanced representation, shared wording and meaningful participation is essential to secure unbiased and legitimate outcomes. MCA can be a leverage to increase ownership of restoration actions choice by local stakeholders, and opportunities for sustainable and successful embedment of restoration actions into the environmental, social, cultural and economic context of the site.

Overall, the MCA framework is highly applicable to wetlands restoration decision-making as a multidimensional analysis tool which integrates social perception of criteria importance. It is suitable for the evaluation and comparison of alternatives based on more than one criterion or objective which are difficult to quantify or express in monetary terms. In comparison, other economic evaluation tools like cost-effectiveness analysis and cost-benefit analysis (CBA) tend to be applicable for monetized or single variables, while wetlands restoration requires to consider a set of different factors.

Risks and uncertainties associated with MCA method:

- Results of the MCA are difficult to generalise due to their dependency on the context, on the representativeness of local stakeholders' groups, perception of the importance of each criterion, the characteristics of restoration scenarios, and specific characteristics of wetlands in question.
- The MCA results may vary depending on the normalisation algorithm used; three normalisation algorithms were tested in RESTORE4Cs pilot sites (Max, Min-Max, Vector) to limit risks of methodological biases and increase results consistency.
- The MCA method is time consuming and implies a strong engagement from stakeholders, as well as an adaptation of the wording and crafting of the indicators´ selection adapted to the local context and perception. **A pre-analysis of the socio-cultural and socio-economic background is necessary to prepare the ground in the most efficient way.**

Camargue, France
Source: © RESTORE4Cs, University of Salento/LIFEWatch ERIC

Good Practice Case: Applying Multi-Criteria Analysis in the Camargue Pilot Site (France)

At the RESTORE4Cs pilot site in Camargue, France, the full MCA methodology was applied combining stakeholder input with ecological and economic indicators. Stakeholders weighed criteria across themes (environmental, socio-economic, socio-cultural) and evaluated three 2050 scenarios: 1) adaptive NbS management (business-as-usual), 2) natural evolution, and 3) hydraulic engineering. The process revealed a preference for NbS scenarios that balanced climate benefits with cultural heritage and livelihoods (e.g., cattle breeding, reed harvesting), even though "naturally evolving" landscapes had lower investment costs. This case demonstrated how restoration choices can be shaped by local identity and risk tolerance, rather than being driven solely by cost or GHG potential.

Other evaluation methods

Other methods can also play a valuable role in assessing costs and benefits of restoration actions. For example, although **CBA** could not be applied in RESTORE4Cs pilot sites due to data limitations and difficulties to quantify or monetise specific variables (cultural, social), it can be useful at national or river basin levels to guide restoration priorities under budget constraints. In CBA, for each euro invested in a project, benefits which are generated or expected at a given time horizon should be monetised.

Moreover, the **ecosystem services assessment** offers a broader view by highlighting other benefits, such as biodiversity conservation and water quality improvements. In RESTORE4Cs, the combination of AquaLinks tool, MCA, and Meta-Analytic Value Transfer (MAVT) methodologies provided a foundation for evaluating restoration project impacts across multiple dimensions[51].

51 Oliveira et al. (submitted): *Assessing Pressure Levels of a Wetland using the LUPLES model: Data sources and policy objectives perspective*. Earth System Governance.

Key recommendations

- → **Focus on high-impact restoration actions** to maximise climate benefits per €. **Balance climate targets with co-benefits** like flood protection, recreation, and livelihoods to increase public support. Ensure **fair distribution of benefits and costs**, especially for local communities.
- → The **choice of methods to assess costs and benefits** of coastal wetland restoration actions can shape the solutions selected for restoration.
- → **MCA** is recommended **to assess and balance restoration options beyond just cost or climate benefits**, including social and ecological aspects and when evaluating complex trade-offs (e.g. carbon storage vs. tourism vs. local livelihoods). In doing so, it is necessary to engage relevant stakeholders early to reflect local values, capture their preferences and contribute to the social acceptance of restoration plans. A pre-analysis of the socio-cultural and socio-economic background is important to prepare the ground in the most efficient way.
- → **ACCs** can be used to support **identification and prioritisation of the most cost-effective wetland restoration actions** (e.g., peatland rewetting, conversion of altered land to wetlands) **for reducing GHG**. To reach a higher level of precision, site-specific data is essential for conducting this type of analysis. Further, using tCO_2eq/global warming potential metrics allows to reduce risks of rebound effect.
- → Other methods can also be considered for assessing costs and benefits of restoration actions, e.g., CBA and ecosystem services assessment, as they provide valuable insights at scales or on dimensions not covered by MCA and ACCs.

Where to find more information

- **RESTORE4Cs Deliverable:** Report on cost/benefit analysis of wetland restoration options and on financing tools (2025)[52]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).
- **RESTORE4Cs Deliverable:** Report on the assessment of co-benefits and economic valuation of ecosystem services provision (2025)[53]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).
- **RESTORE4Cs Deliverable:** Social acceptability of wetland restoration and management (2025)[54]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

52 Authors: Anglada, C., Massoutier, J., Lago, M., Ciravegna, E., Raoult, J., Polman, N., Bodivit, A., Sella, L., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Bučas, M., Beekman, V., Geamana, N., Giuca, R.C., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M.J., Morant, D., Rota, F.S., Štrbenac, A., Oliveira, B., Lillebø, A.

53 Authors: Oliveira, B., Nogueira, A., Lillebø, A.

54 Authors: Sella, L., Rota, F. S., Pollo, N., Vivaldo, G., Anglada, C., De Fusco, G., Ciravegna, E., Massoutier, J., Bodivit, A., Khavandgaran, S., Omidmand, M., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Beekman, V., Polman, N., Raoult, J., Giuca, R. C., Geamana, N., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M. J., Morant, D., Štrbenac, A., Lillebø, A., Sousa, A., Coelho, P., & Oliveira, B.

3.4.3 Identify funding sources

- How to pay for coastal wetland restoration?
- What is the most accessible funding source?
- Can conservation and restoration actions be financed with private funding?
- How can financing needs for long-term restoration and maintenance be matched with suitable public and private instruments?

Securing adequate and sustainable funding is one of the most pressing challenges in coastal wetland restoration. While public funds (especially from EU programmes) remain essential, they are often specific for the restoration itself, project-based, sector-oriented or not taking into account long-term ongoing and recurring operational cost. The current models also rarely link funding to ecological performance or long-term ecosystem service delivery, limiting incentives for adaptive management. Recurring costs, such as monitoring, hydrological regulation, adaptive management, education and outreach activities, often remain underfunded[55]. Identifying and mobilising diverse public and private funding sources, including climate finance, biodiversity-focused instruments, and private sector contributions, is key to scaling and long-term sustaining restoration efforts. A proactive financing strategy ensures that restoration is not only technically, socially and economically viable but also financially feasible and resilient to policy shifts.

To identify suitable funding sources, the following steps are proposed:

1. **Collect financial and contextual information** from the areas where restoration is to take place. Determine geographic location, relevant stakeholders, designation status, wetland type, the scale and restoration objectives which will support in matching the right funding source. Identify ecosystem service benefits, informed by stakeholder and expert assessments. Identify potential funding sources (e.g. blended finance or Payments for Ecosystem Services (PES)) and instruments already used, as well as possible revenue streams and ultimately financial gaps.
2. **Compile an inventory of public and private financing opportunities** in the respective country, region or municipality. Use existing literature, expert interviews, and financing inventories, for example, those developed as part of the RESTORE4Cs and the PONDERFUL[56] projects.
3. **Match the site needs with appropriate funding tools and their requirements.** Ensure eligibility and the alignment of funder´s priorities with restoration objectives.

55 Anglada, C. et al. (2025). Report on cost/benefit analysis of wetland restoration options and on financing tools. Deliverable. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

56 PONDERFUL. (n.d.). Home. PONDERFUL. Available at: https://ponderful.eu/

Support from RESTORE4Cs

Sustainable Finance Inventory

RESTORE4Cs mapped existing and potential funding sources and financing instruments applicable for restoring coastal wetlands in the European context. A total of **29 instruments** were collected using desk-based literature review, described and supported with successful practice examples, allowing for more detailed insights and practical applications drawn from existing case studies and projects (see Table 7). To gather and update the information about the instruments in a consistent manner, a financing instrument review template, developed in the PONDERFUL project, was utilised[57].

This Sustainable Finance Inventory offers an overview of existing financial and funding instruments and allows decision-makers to identify the most appropriate funding sources for the site specifics and needs. It helps for instance to develop **blended finance strategies** that combine grants, market-based instruments, and private capital, and to identify **co-funding opportunities** under national climate, biodiversity, and water programmes.

Table 7: The RESTORE4Cs Sustainable Finance Inventory – Categories and instrument structure.

Main category	Category definitions	Instruments	Examples	Broad categorisation
1. Income instruments	Instruments for raising revenue that can then be used to finance NbS. Some can be used by landowners (1.1, 1.4, and 1.5); others can only be levied by government-sanctioned associations (1.2 and 1.3) or govern-ments (1.6).	1.1 User fees	Camargue Wetlands (France)	Revenue
		1.2 Business improvement districts	The Thames Estuary Partnership and Growth Board, England (UK)	Funding: private
		1.3 Betterment levies	Wimbledon and Putney Commons (UK)	Funding: public
		1.4 Development rights and leases	Marker Wadden (The Netherlands)	Revenue
		1.5 Sale of market goods	Mangrove honey in Ban Nai Nang (Thailand)	Revenue
		1.6 Other revenue raising measures	The Forest of Marston Vale, Bedford (UK)	Revenue/ funding
2. Contracting approach (cost reduction/ restructure)	Legal agreements that reduce or restructure the costs of financing NbS, either by providing assets or use of assets at below market rates (2.1) or by shifting financing of up-front costs in return for ongoing ayments (2.2).	2.1 Community asset transfer	Verdier Marshes, Camargue (France)	Cost avoidance/ reduction
		2.2 Public-private partnership (PPP)	Gujarat coast (India)	Cost avoidance/ reduction

57 McDonald, H. et al. (2023). *Synthesis report on sustainable financing of the establishment of ponds and pondscapes*. PONDERFUL Project (EU Horizon 2020 GA no. ID869296), Deliverable 1.4. Available at: https://www.ecologic.eu/sites/default/files/publication/2023/33005-D1_4-Sustainable-Financing.pdf.

3. Voluntary contributions/ donations	Voluntary payments made of own free-will, whether a direct beneficiary of the NbS (3.2) or simply to contribute (3.1, 3.3.)	3.1 Philanthropic contributions	The Living Danube Partnership	Funding: private
		3.2 Voluntary beneficiary contributions	The Wetlands Institute, New Jersey (USA)	Funding: private
		3.3 Crowdfunding	Treflach Wetland, England (UK)	Funding: private
4. Tradable rights/permits and PES	Financing is raised by selling the 'rights' to ecosystem services generated by the NbS. This payment can be relatively informal (4.1) or through structured markets for climate change mitigation (4.2), for offsetting negative impact on wetlands (biodiversity, loss of habitat, carbon sequestration, ecological etc.) (4.3), or for reducing water pollutants (4.4).	4.1 PES	Sebou Water Fund, MENA region (Morocco)	Revenue
		4.2 Transfer-based instruments: voluntary (blue) carbon markets	The Nature Conservancy, Aotearoa (New Zealand)	Revenue
		4.3 Transfer-based instruments: Wetland offsets	Innisfil reeks, Ontario (Canada)	Revenue
		4.4 Transfer-based instruments: Water quality trading systems	Chesapeake Bay, Pennsylvania (USA) nutrient credit trading	Revenue
5. Subsidies	Subsidies are a financial contribution from the government to a person, company or organisation to promote socially beneficial outcomes. They can be ongoing payments (or tax breaks) linked to outcome or production (5.1, 5.2).	5.1 Environmental subsidies	Peatlands (The Netherlands)	Funding: public
		5.2 Tax concessions	Arkansas (USA)	Funding: public
6. Grants	Direct contribution from government (local, national, or EU) to a recipient in return for undertaking a specific activity. Grants are generally one-off payments (though they may be paid in instalments), and often competitive (6.1).	6.1 Grants	Mechelen (Belgium); Tilburg (The Netherlands); Lithuania and Latvia	Funding: public
7. Debt instruments	Transfer of capital in return for a promise to repay that capital over time, generally with interest. This can involve direct lending from a lender to a borrower (7.1) or be mediated through debt markets (7.2).	7.1 Loans and green loans	Linnunsuo (Finland); Winona Wetlands (USA)	Debt/equity finance
		7.2 Bonds and green bonds	Pelican River Forest, Wisconsin (USA)	Debt/equity finance

8. Equity finance	Financing raised by selling an ownership share of the NbS, potentially with a claim to some of its profits. This can be motivated by a desire to have impact (8.1), investing in early stage sustainable startups or projects (8.2), accelerating the potential of a restoration action (8.3), private investment application (8.4), or be purely commercial purpose (8.5).	8.1 Impact investing	Sumatra Merang Peatland Restoration Project (Indonesia)	Debt/equity finance
		8.2 Business angles	Grassland in Brankley Pastures (UK)	Debt/equity finance
		8.3 Accelerators/ Incubators	Northern Highlands/ Diana (Madagascar)	Debt/equity finance
		8.4 Private equity	Sacramento Bay Delta (USA)	Debt/equity finance
		8.5 Commercial investing	Mill Creek Mitigation Bank (US)	Debt/equity finance
9. Financing risk management	Financial risk management involves identifying the potential downsides in any investment decision and deciding whether to accept the risks or take measures to mitigate them. This can be done through blended finance (9.1), guarantees (9.2) or insurance (9.3).	9.1 Blended finance	Coastal Protection with carbon credits from blue carbon sources (The Netherlands)	Funding: private/ public
		9.2 Guarantees	Green Guarantee to support Small and Medium Enterprises (Peru)	Funding: private/ public
		9.3 Insurance	Insurance Bureau of Canada (IBC) for Wetland Restoration	Funding: private/ public

Source: RESTORE4Cs Deliverable: Report on cost/benefit analysis of wetland restoration options and on financing tools (2025).

Table 8 presents a summary of funding instrument types available for coastal wetland restoration, highlighting the potential role of each type and challenges associated with them.

Table 8: Summary of Funding Instrument Types for Coastal Wetland Restoration.

Type of Funding Source	Potential Role	Challenges
EU & national funds	Restoration planning and implementation	Short project cycles, access burden
Climate finance	GHG mitigation-focused actions	Requires CO_2/CO_2eq metrics
Private sector	Co-financing, Corporate Social Responsibility (CSR), infrastructure links	Needs incentives and trust
Market-based instruments	Long-term sustainability (e.g., PES such as carbon/nature credits)	Weak enabling environment

Financing plans for restoration sites

In RESTORE4Cs, financing plans for the project pilot sites were developed and presented in RESTORE4Cs Deliverable "Report on cost/benefit analysis of wetland restoration options and on financing tools". A general qualitative template was designed to ensure the systematic collection and organisation of financial and contextual information across all pilot sites. The template can be adapted to stakeholder needs. The template guides researchers in documenting key aspects of their restoration projects under consistent headings:

1. Case pilot context (geographic location, designation status, and wetland type).
2. Past and future restoration actions and challenges, detailing environmental pressures and intervention strategies.
3. Benefits of restoration: ecosystem service benefits, informed by stakeholder and expert assessments.
4. Financial cost of restoration: distinguishing one-off capital expenditures from ongoing operational costs.
5. Financing mechanisms, including funding sources and instruments used.
6. Revenue and funding gaps, highlighting sustainability risks.
7. Conclusion and potential financing solutions: proposing strategies to strengthen long-term financing.

The template played a crucial role in standardising data inputs, facilitating cross-site comparison, and supporting the synthesis of findings on wetland restoration financing under the RESTORE4Cs project. The information collected in such systematic manner can be used to prepare a financing plan for specific restoration sites reflecting both on the current situation, i.e. past or existing plans for restoring coastal wetlands, and the future situation, covering future restoration plans that have not yet been implemented.

Key recommendations

- → Develop **multi-source financing strategies** involving relevant stakeholders, combining public and private instruments tailored to local restoration needs.
- → **Secure long-term funding** not just for restoration but also for maintenance, considering a mix of public and innovative finance tools.
- → Bridge the funding gap: **Private financing** has often been an untapped potential to complement public and EU funds, especially **for long-term maintenance and operational costs**.

→ Consider enabling **regulatory environments for innovative financing** (e.g., green bonds, biodiversity credits, PES) and provide support to build blended finance capacity among public and civil society actors.

→ *See more recommendations in section 3.6.3 on "Public-private partnerships".*

Where to find more information

- **RESTORE4Cs Deliverable:** Report on cost/benefit analysis of wetland restoration options and on financing tools (2025)[58]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).
- **RESTORE4Cs Deliverable:** Report on the assessment of co-benefits and economic valuation of ecosystem services provision (2025)[59]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).
- **RESTORE4Cs Deliverable:** Social acceptability of wetland restoration and management (2025)[60]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).
- **RESTORE4Cs Policy Brief No. 4:** Beyond public funds: diversifying financing for wetland restoration (2025)[61].

58 Authors: Anglada, C., Massoutier, J., Lago, M., Ciravegna, E., Raoult, J., Polman, N., Bodivit, A., Sella, L., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Bučas, M., Beekman, V., Geamana, N., Giuca, R.C., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M.J., Morant, D., Rota, F.S., Štrbenac, A., Oliveira, B., Lillebø, A.

59 Authors: Oliveira, B., Nogueira, A., Lillebø, A.

60 Authors: Sella, L., Rota, F. S., Pollo, N., Vivaldo, G., Anglada, C., De Fusco, G., Ciravegna, E., Massoutier, J., Bodivit, A., Khavandgaran, S., Omidmand, M., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Beekman, V., Polman, N., Raoult, J., Giuca, R. C., Geamana, N., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M. J., Morant, D., Štrbenac, A., Lillebø, A., Sousa, A., Coelho, P., & Oliveira, B.

61 Author: Ciravegna, E.

3.4.4 Sustain restoration outcomes, including through monitoring for adaptive management

→ How to ensure the sustainability of restoration outcomes in the long term?

Coastal wetland restoration delivers both short-term and long-term benefits to people, nature and economy. However, realising the long-term potential of coastal wetland restoration is only possible if restoration outcomes are sustained over time. To sustain the outcomes of restoration and prevent reversal due to natural disasters or poor management, it is essential to integrate **long-term strategies and risk mitigation measures**, in particular:

- **Maintenance:** Maintenance and routine management of the restoration actions, e.g., removing invasive species, repairing erosion damage, sustaining hydrological regime and structure of the ecosystem, enables effective adaptive management[62].
- **Climate-resilient design:** The planning of site-specific restoration actions for coastal wetlands should account for projected sea-level rise, storm frequency, and rainfall changes as well as risk mitigation measures in case of natural disasters in particular floods and prolonged droughts.
- **Stakeholder and community engagement:** Making local population active stakeholders in the restoration action develops a sense of ownership and stewardship and increases chances of continued support and long-term maintenance after the restoration project comes to an end.
- **Long-term monitoring and adaptive management:** It involves monitoring the restoration outcomes and adjusting restoration actions based on changing environmental conditions or failures of previous interventions. Adaptive management relies on regular feedback loops from an underlying monitoring which is designed carefully and efficiently.

Long-term monitoring can also inform the update of tailored indicators to track the ecological health and stability of the restored coastal wetland as well as the amount of carbon stored by these restored ecosystems. In this context, adaptive management frameworks and monitoring are also key to carbon market instruments[63]. Participation of coastal wetland restoration projects in carbon crediting mechanism requires, among others, monitoring and reporting of restoration outcomes over time to verify carbon sequestration and/or emission reductions, including permanence of carbon storage.

Limitations and uncertainties

- Limited opportunities to cover recurring and maintenance costs, such as monitoring, adaptive management, education and outreach activities, which often remain underfunded by the public funding instruments[64].
- Monitoring restoration actions at the site level may be difficult, since monitoring tools such as Earth Observation do not always capture the granularity of processes and changes happening at site level.

62 Misteli, B. et al. (2025). *How can coastal wetland restoration mitigate climate change? What we know and what is still unclear.* Policy Brief. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-9-v7_Final.pdf.

63 Ibid.

64 Anglada et al. (2025). *Report on cost/benefit analysis of wetland restoration options and on financing tools.* Deliverable. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Support from RESTORE4Cs

Within RESTORE4Cs, data relevant to monitoring coastal wetlands status and restoration is linked with **spatial and modelling approaches**. For instance, wetland use intensity maps derived from Sentinel-2 time-series data (satellite images) can serve as a benchmark for assessing pressures from agricultural activities and the impact of restoration efforts over time (see roadmap section 3.2.3 "Assess current conditions of coastal wetlands"). Given limited resources for monitoring based on manual data collection and field surveys, advanced technologies like remote sensing are emerging as a critical tool for tracking changes in wetland extent, vegetation structure, hydrology, and ecosystem function over large spatial and temporal scales. By combining remote sensing alongside other advanced technologies with in-situ measurements, trends in restoration results can be detected, and interventions adapted, if needed.

Furthermore, RESTORE4Cs provides inputs into various aspects of the process of sustaining restoration outcomes and monitoring for adaptive management in the following roadmap sections:

- Section 3.3.2 **"Map potentially restorable wetlands"** integrates climate change scenarios, namely the sea-level rise projections, allowing for informed and future-proof planning of restoration activities.
- Section 3.4.3 **"Identifying funding sources"** addresses the aspect of the potential sources of funding of maintenance costs (e.g., revolving funds and conservation endowment) which are required to sustain the restoration results.
- Section 3.6.2 **"Establish a governance structure that enables collaboration and trust between stakeholder and builds long-term commitment towards restoring wetlands"** deals with ways of engaging local communities, crucial for sustaining restoration outcomes.
- Section 3.4.2 **"Assess benefits and costs of restoration actions for climate change mitigation"** proposes ways to assess preferences of stakeholders for restoration options to increase legitimacy of restoration decisions by considering local values.

Key recommendations

→ Allocate human resources to ensure **regular long-term monitoring and reporting**.

→ Integrate **advanced technologies and collaborative approaches for monitoring** coastal wetlands. Collaboration among scientists, policymakers, and local communities is necessary for refining these advanced tools and tailoring them to regional contexts[65].

→ Make all methods, results, and geospatial data **publicly available in open-access repositories** that are interoperable with national inventory systems to ensure transparency[66].

65 Otero, M.M. et al. (2025). *European Coastal Wetland Indicators: A proposal for monitoring policy process across space and time*. Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-6-v2_Final.pdf.

66 Misteli, B. et al. (2025). *How can coastal wetland restoration mitigate climate change? What we know and what is still unclear*. Policy Brief. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-9-v7_Final.pdf.

3.4.5 Learn from past restoration experiences in coastal wetlands

→ How to identify good practices and methodologies for restoring coastal wetlands and learn from them?

Ecological restoration, especially in the context of intensifying climate change, is linked to a high level of unpredictability and financial risk. These high risks have the potential to discourage investments and weaken political commitment given the lack of a guaranteed return on investment. For this reason, and to minimise these risks, it is advisable to exchange with other managers who have performed ecological restoration in a similar setting.

Support from RESTORE4Cs

The European Community of Practice (ECoP) for Restoring Wetlands developed in the framework of RESTORE4Cs (see box below) offers the opportunity to establish contact with other managers or managing entities with experience in the restoration of coastal wetlands and other types of wetlands. The first Working Group of this community aims to replicate the methods applied in the RESTORE4Cs project for assessing the improvement in coastal wetlands' capacity to reduce GHG emissions following restoration.

European Community of Practice for Wetland Restoration

The RESTORE4Cs Community of Practice for Wetland Restoration seeks to mobilise a wide range of stakeholders to accelerate joint action for restoring and conserving wetlands across Europe and beyond. By involving site managers, private businesses, researchers, decision-makers, civil society organisations and other restoration champions, this Community aims to:

- **Act as a knowledge hub** for practitioners and experts seeking guidance on implementing wetland restoration strategies that optimise carbon sequestration and reduce GHG emissions.
- **Promote cross-regional learning and the replication of successful restoration approaches** by facilitating exchanges between experts working in different ecological, cultural, and regulatory contexts. By showcasing best management practices and proven restoration techniques, the Community encourages members to adapt, adopt, and scale up effective solutions in their own regions.

This community seeks to cultivate a collaborative and respectful environment for learning and growth, where members can build knowledge and skills collectively, identify training needs from different actors, and co-design new training materials and initiatives. Figure 17 visualises the goals and participating actors of the ECoP for coastal wetland restoration.

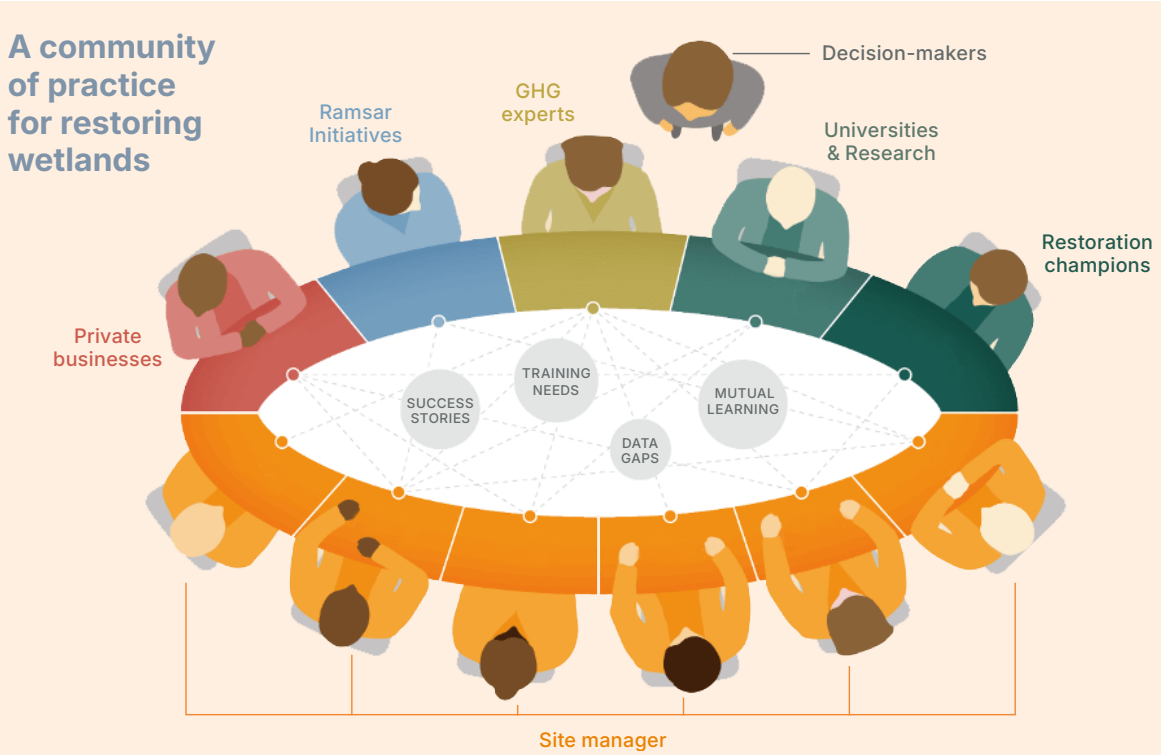


Figure 17: Visualisation of the ECoP for restoring wetlands created as part of the RESTORE4Cs project. Source: RESTORE4Cs Policy Brief: Fostering inclusive and cross-sectoral action for wetlands: Building a Community of Practice supporting Ramsar Convention on Wetlands Resolution XIV.17 (2025).

The ECoP is hosted on the Wetland-based Solutions platform (https://www.wetlandbasedsolutions.org/). Joining and participating in the Community is possible via https://www.wetlandbasedsolutions.org/community-of-practice-wetlands/.

Key recommendations

→ Participate in the ECoP to **exchange on best practices in coastal wetland restoration** across Europe and increase knowledge on the latest scientific developments.

Where to find more information

- Website of the European Community of Practice.

3.5 Policy integration

- How to improve integration of coastal wetlands in national policies linked to EU and international targets on climate, biodiversity and other policies?
- How can policy targets be further specified to support restoration actions for coastal wetlands?

3.5.1 Enhance coastal wetland restoration in national climate policies

Since the 2015 Paris Agreement negotiations, EU climate policies increasingly include provisions for wetlands restoration. RESTORE4Cs findings highlight growing policy support for coastal wetland protection and restoration within the EU climate policy domain. Climate change mitigation is acknowledged as an important ecosystem service of wetland restoration in many EU policies and international agreements relevant to wetlands, ranking second only to biodiversity support[67]. Aligning national policies with EU and international commitments and better integrating coastal wetland restoration into national climate policy is necessary for more effective climate actions and achieving EU climate targets.

Support from RESTORE4Cs

According to RESTORE4Cs project findings[68]:

- Restoration actions, depending on the location and characteristics of each wetland, generally have a positive or at least neutral impact on climate regulation. In some coastal wetlands, restoration delivers clear climate change mitigation benefits across seasons, for example, in the seagrass beds of the Ria de Aveiro (Portugal) and the freshwater lagoon of the Curonian Lagoon (Lithuania).
- Seasonality and vegetation presence play an important role in shaping the climate benefits of coastal wetland restoration.
- Due to the high variability among and even within wetland ecosystems, tailored, site-specific restoration strategies are essential to sustain and enhance their climate-regulating function.

Given the potential of coastal wetlands for climate change mitigation as well as known benefits for adapting to negative impacts of climate change, coastal wetland restoration can be further promoted by aligning it more closely with actions planned under climate policy instruments at national level (see Figure 18).

67 Kampa, E. et al. (2024). *Policy analysis and policy demands for data, methods, and tools (Part A)*. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance)

68 Misteli, B. et al. (2025). *How can coastal wetland restoration mitigate climate change? What we know and what is still unclear*. Policy Brief. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-9-v7_Final.pdf.

- **National GHG inventories and LULUCF data:** The comprehensive and complete inclusion of wetlands in annual national GHG inventories submitted to the European Commission (EC) and the United Nations Framework Convention on Climate Change (UNFCCC) enables the quantification of how mitigation initiatives (e.g., avoiding loss or degradation of wetlands and/or the restoration or creation of wetland habitat) may contribute to a country meeting its international GHG commitments.

  The LULUCF Regulation makes accounting for emissions and removals from wetlands obligatory as of 2026, which should encourage countries to reduce emissions associated with them and to enhance their carbon sink capacity. Keeping an account of wetland emissions and removals under the LULUCF Regulation from 2026 onwards provides the opportunity at national level to enhance climate ambitions with emission reductions and removals through actions that favour mitigation measures for wetland ecosystems. National authorities should consider the inclusion of coastal wetlands in the LULUCF reporting, following the example of France and Malta, which have been integrating marshes into their national GHG inventories under the UNFCCC.

- **National Energy and Climate Plans:** Coastal wetland restoration and conservation measures can be integrated in National Energy and Climate Plans (NECPs) as effective NbS that help meet national GHG reduction and natural sink enhancement targets, in line with national LULUCF commitments on sector-wide net GHG removal target and EU 2030 and 2050 climate targets.

- **National adaptation strategies:** Wetland restoration should be recognised as an adaptation measure in national adaptation strategies, which are required to promote NbS. As the EU Adaptation Strategy highlights, restoring wetlands and coastal areas is a cost-effective solution for climate resilience.

- **Carbon removal certification:** Blue carbon farming should be promoted; this can be supported by the EU CRCF Regulation, provided necessary social and environmental safeguards are in place. The CRCF applies to carbon farming activities, which include practices that enhance carbon sequestration in soils, biomass, and ecosystems. This scope is broad enough to encompass blue carbon ecosystems such as saltmarshes and seagrass meadows, provided methodologies are developed and safeguards are respected. Certifying carbon removals from restoration of coastal wetlands creates a lever to mobilise additional funding for the restoration and long-term resilience of these habitats, as demonstrated e.g., by the results of the LIFE Blue Natura[69] and LIFE Wetlands4Climate projects[70].

69 LIFE Blue Natura. (n.d.). *Home*. LIFE Blue Natura. Available at: https://life-bluenatura.eu/en/home/.

70 Wetlands4Climate. (n.d.) *Wetlands as Carbon Sinks*. Wetland4Climate LIFE Project. Available at: https://fundacionglobalnature.org/wetlands4climate/en/inicio-english/.

Good practice case: Andalusian carbon offsetting mechanism and coastal wetland restoration

In Andalusia, Spain, a voluntary mechanism for carbon offsetting projects was introduced in 2018 to support projects that contribute to climate change mitigation. This initiative includes the restoration and conservation of coastal ecosystems, including coastal wetlands, as eligible activities. In addition, a management and evaluation of GHG methodology was introduced, specifically emphasising natural carbon sinks within protected areas. In particular, the development of a blue carbon offset methodology specifically tailored to wetlands and seagrasses was facilitated. The Andalusian Climate Action Plan 2021–2030[71] complements this initiative, further developing the Catalogue of Emission Offset Projects, monitoring provisions and outlining tools to support the integration of blue carbon projects into CO_2 emissions offsetting initiatives.

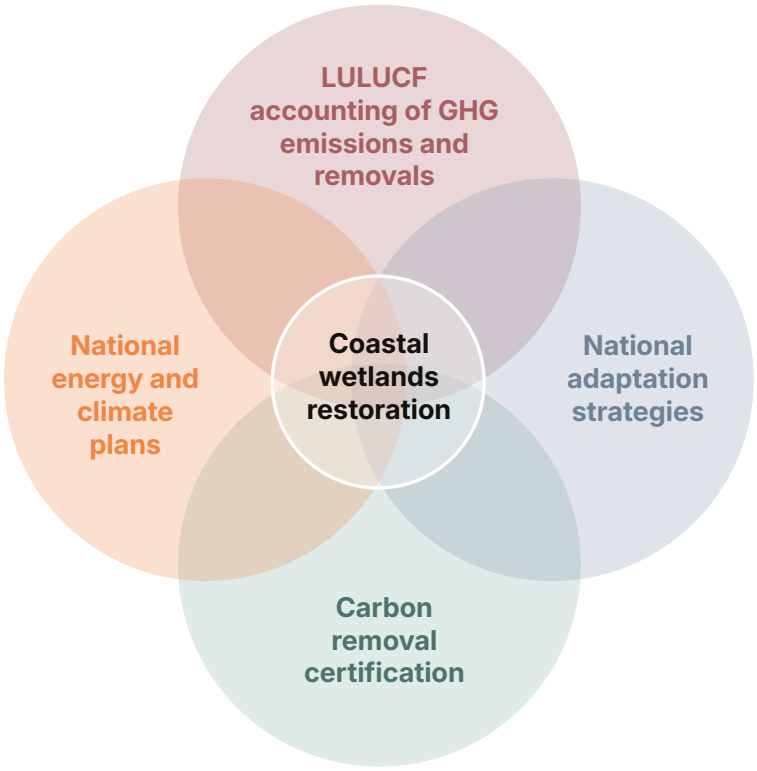


Figure 18: Integration of coastal wetland restoration into national climate planning and strategic documents.

71 Junta de Andalucía. (2021). *Andalusian Climate Action Plan 2021–2030 (Decree 234/2021).* Available at: https://www.juntadeandalucia.es/boja/2021/587/1.

Key recommendations

- → Systematically collect **more information on carbon stock and carbon storage (GHG removal) and emissions reductions capacity** of coastal wetlands.
- → Adopt tailored, **site-specific strategies for wetland restoration** to support and enhance climate change mitigation function of coastal wetlands.
- → Consider **coastal wetlands in the obligatory accounting of wetlands GHG emissions and removals under the LULUCF Regulation** in 2026–2030.
- → Include **coastal wetland restoration and conservation measures as effective NbS in NECPs**. Promoting coastal wetland restoration as a climate change mitigation solution can also contribute to securing funding under new EU priorities, set forth in the EU Competitiveness Compass which explicitly mentions climate aspects.
- → Recognise **wetland restoration as a cost-effective adaptation measure in national adaptation strategies**.
- → Integrate **coastal wetlands in carbon crediting and carbon offset mechanisms**. Examples of such policies in Spain illustrate that they can promote coastal wetland restoration to achieve both climate and environmental goals.

Where to find more information

- **RESTORE4Cs Deliverable:** Policy analysis and policy demands for data, methods, and tools (Part A) (2024). Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance)[72].
- **RESTORE4Cs Policy Brief No. 2:** Unlocking potential of coastal wetlands in Europe: Integration into National Restoration Plans (2025)[73].
- **RESTORE4Cs Policy Brief No. 9:** How can coastal wetland restoration mitigate climate change? What we know and what is still unclear (2025)[74].

72 Authors: Kampa, E., Bueb, B., Elkina, E., Otero, M.M., Abdul Malak, D., Schröder, C., Sanchez, A., Guelmami, A., Ronse, M., Kataržytė, M., Vaičiūtė, D., Bučas, M., Raoult, J., Speijer, F., Lillebø, A., Carvalho, T., Geamănaă, N., Cazacu, C., Racoviceanu, T., Camacho, A.

73 Authors: Kampa, E., Elkina, E., Otero, M.

74 Authors: Misteli, B., Attermeyer, K., Rochera, C., Lilebø, A., Camacho, A.

3.5.2 Enhance coastal wetland restoration in national biodiversity and nature restoration policies

At EU and international level, several legally binding policy targets for coastal wetlands restoration and conservation stem from nature and biodiversity policies, in particular the EU NRR, the EU Birds and Habitats Directive and the Ramsar Convention. These legally binding targets serve as powerful policy levers for driving conservation and restoration efforts at both national and sub-national levels.

At national level, coastal wetland restoration can be further promoted by aligning it closely with actions planned under biodiversity and nature protection policy instruments.

Support from RESTORE4Cs

The RESTORE4Cs tools support the quantification of targets for coastal wetland restoration by providing key inputs for baseline assessments, identifying the share of potentially restorable areas, and guiding the site prioritisation process.

Through the baseline assessment, the total extent of wetlands within the national territory can be determined, including the proportion of areas protected under the Natura 2000 network. Within this total wetland area, information on potentially restorable areas, both previously lost wetlands and existing wetlands in poor conservation status, helps identify total areas for restoration planning.

go to the ***interactive toolbox***

Further, the **Spatial Decision-Support Toolbox** enables the prioritisation of areas suitable for restoration by considering factors, such as the effort required for restoration, the current conservation status, and future climate change scenarios (e.g., sea-level rise). Based on this process and national challenges and priorities identified by public authorities, evidence-based decision-making in selecting and sequencing restoration interventions is supported.

Using these insights, national (and sub-national) policy targets can be specified in several planning instruments to enhance coastal wetland restoration (see Figure 19):

- **National Restoration Plans.** By September 2026, EU countries must submit to the EC their draft National Restoration Plan under the EU NRR, outlining how they plan to achieve the restoration targets for all ecosystems addressed in the Regulation, including coastal wetlands. The EU NRR focuses on degraded ecosystems with the greatest potential to prevent and mitigate natural disasters like floods and droughts, as well as on those best suited to capture, store and sequester carbon. The National Restoration Plans present a strategic opportunity to scale up the restoration and re-establishment of lost coastal wetlands, and to enhance their role in carbon storage, reducing GHG emissions and delivering a range of other co-benefits. The National Restoration Plans will be finalised by September 2027 and revised in 2032, and afterwards every 10 years. National competent authorities will need to submit a first national report on progress in implementing the National Restoration Plan in 2031 and then every 6 years.

- **National biodiversity strategies and action plans** should clearly define coastal wetland restoration as a national priority and align it with the targets of the EU Biodiversity Strategy and global frameworks. They may also include specific coastal wetland restoration targets. For example, the National Biodiversity Strategy in France (2021–2030) includes coastal wetland restoration as a key component with specific actions, particularly in the context of climate change adaptation and the preservation of ecosystem services (see a good practice case below).
- **Natura 2000 management plans.** These plans are foreseen under the EU Birds and Habitats Directives, and they provide a legal and strategic framework to manage and restore protected areas, including coastal wetlands. Since the final decision regarding the adoption of management plans lies within the discretion of national authorities, there is room for improved coverage of coastal wetlands by Natura 2000 planning documents. A good practice example can be observed in the Netherlands, where the delineation and naming of the existing Ramsar sites, including coastal wetlands, are adapted to the Natura 2000 delineation and naming which improves the overall efficiency, especially in terms of drawing up management plans and in monitoring processes[75].

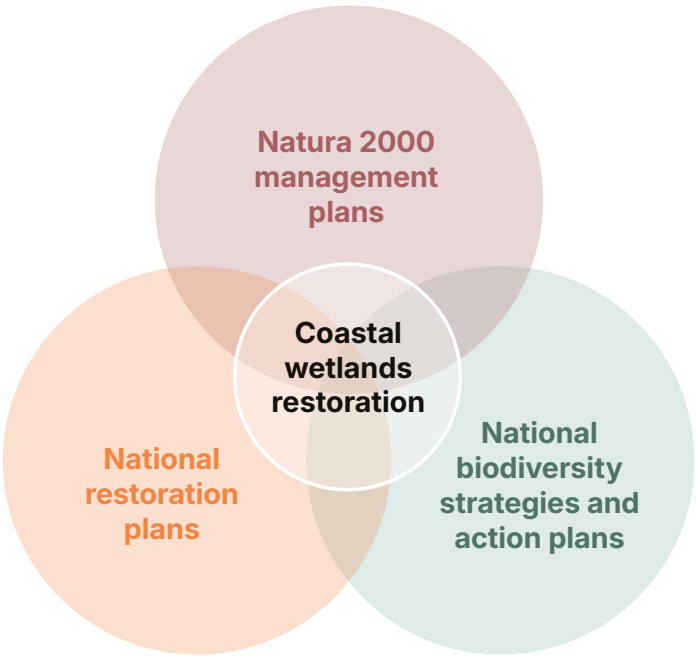


Figure 19: Integration of coastal wetland restoration into national nature planning and strategic documents.

75 Kampa, E. et al. (2024). *Policy analysis and policy demands for data, methods, and tools (Part A).* Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

Good practice case: 4th National Wetlands Plan 2022 – 2026 in France under the National Biodiversity Strategy 2030

The N**ational Wetlands Plan 2022 – 2026**[76] (2022) is a non-binding policy and an offshoot of the National Biodiversity Strategy 2030 (2021). It expands existing actions to promote the knowledge, protection, and restoration of wetlands. At least €325 million is to be earmarked by the State and its operators in 2022 – 2026 to implement the National Wetlands Plan.

Specific objectives for wetland restoration:

- **double the surface area of wetlands under high protection in mainland France by 2030** and strengthen the inclusion of these environments in all protected areas in mainland France, i.e. an increase of around 110,000 ha. A similar ambition will be pursued in all protected areas of various statuses.
- **acquire 8,500 ha of wetlands** and create new protected areas, including a 12th national park dedicated to wetlands specifically.
- **restore 50,000 ha of wetlands** by 2026.
- improve the functioning of wetlands by **restoring watercourses**.

With its third edition published in 2023, the National Biodiversity Strategy 2021 – 2030 commits to continue efforts to restore wetlands as set out in the 4th National Wetlands Plan 2022 – 2026, **targeting 50,000 ha of restored wetlands by 2026**. It elaborates on the following objectives in relation to wetlands:

→ **Action 1:** Continue and set up wetland restoration initiatives with a target of 50,000 ha by 2026.

→ **Action 2:** Define a framework for identifying restoration priorities that should be ready in 2024.

→ **Action 3:** Strengthen resources and help operators to benefit from them.

→ **Action 4:** Strengthen the restoration capabilities of operators by developing the necessary ecological engineering (in terms of skills, know-how and equipment).

76 Ministry of Ecological Transition. (2022). *4th National Wetlands Plan 2022 – 2026*. Ministry of Ecological Transition. Available at: https://www.var.gouv.fr/contenu/telechargement/17928/134101/file/plan_national_milieux_humides_2022-2026.pdf.

Key recommendations

- **Define measurable restoration targets:** In the National Restoration Plan, include specific targets on the type and extent of (coastal) wetland ecosystems to be restored or re-established and the timeframe of the restoration activities (e.g., "restore 100 ha of degraded saltmarsh by 2030").
- **Align restoration efforts** to be foreseen by the **National Restoration Plan with actions planned under climate policy instruments**, in particular National Energy and Climate Plans, national climate change adaptation strategies, and policies for carbon removal certifications, to reinforce the role of wetlands as natural carbon sinks.
- In national biodiversity strategies and action plans, clearly define **coastal wetland restoration and protection as a national priority** and align it with the targets of the EU Biodiversity Strategy and global frameworks. National biodiversity strategies and action plans may also include specific coastal wetland restoration targets.

Where to find more information

- **RESTORE4Cs Deliverable:** Policy analysis and policy demands for data, methods, and tools (Part A) (2024). Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance)[77].
- **RESTORE4Cs Policy Brief No. 2:** Unlocking potential of coastal wetlands in Europe: Integration into National Restoration Plans (2025)[78].

77 Authors: Kampa, E., Bueb, B., Elkina, E., Otero, M.M., Abdul Malak, D., Schröder, C., Sanchez, A., Guelmami, A., Ronse, M., Kataržytė, M., Vaičiūtė, D., Bučas, M., Raoult, J., Speijer, F., Lillebø, A., Carvalho, T., Geamănaă, N., Cazacu, C., Racoviceanu, T., Camacho, A.

78 Authors: Kampa, E., Elkina, E., Otero, M.

3.5.3 Enhance coastal wetland restoration in other national policy areas

Besides supporting biodiversity and contributing to climate change mitigation and adaptation, coastal wetlands deliver multiple other benefits, such as flood risk reduction, regulation of water quality and supply. Based on the analysis of 39 EU policies and multilateral agreements, disaster risk reduction and water regulation functions of (coastal) wetland restoration are supported directly or indirectly in about half of the studied policy and legal instruments[79].

Further policy areas which are relevant to (coastal) wetland restoration and whose objectives can be strengthened for the conservation of these ecosystems include:

- **CAP 2023 – 2027 and national strategic plans**

  National authorities should use the full potential of the CAP Strategic Plans for green interventions that benefit wetlands restoration, specifically using non-productive investments and eco-schemes to protect and restore wetlands in the agricultural landscape.

  Moreover, wetlands will benefit from ambitious and timeline implementation of the Good Agricultural and Environmental Condition (GAEC) 2, whose wetland protection targets should be more clearly defined in the national CAP Strategic Plans by public authorities, e.g., to rule out the maintenance and renewal of wetland drainage systems for direct payments.

- **Flood risk management and river basin management plans**

  The EU Floods Directive presents an opportunity to strengthen coastal wetland restoration by promoting nature-based or hybrid solutions for flood risk management in the context of flood risk management plans (FRMPs) prepared by competent national authorities for their river basin districts. Emphasising the multifunctional benefits of coastal wetlands in flood management, including biodiversity support and climate change mitigation and adaptation, can encourage investment in restoration projects that deliver multiple ecosystem services.

  Same applies to the national river basin management plans (RBMPs) which have room for better integration of wetland restoration as a multifunctional and multi-benefit NbS for water regulation. These measures should be integrated by responsible authorities in the supplementary measures of the RBMPs required under the WFD.

- **Marine and coastal protection strategies**

  Under the MSFD, national authorities are encouraged to include restoration measures for damaged components of marine ecosystems in the national marine strategies and action plans to achieve "good environmental status" target. These recommended measures are relevant to the protection and restoration of marine and coastal wetlands such as seagrass meadows, however, not mandatory for incorporation. Still, there are positive examples, e.g., in the UK, where national action plans that relate to the MSFD[80] include targets for seagrass conservation.

79 Kampa, E. et al. (2024). *Policy analysis and policy demands for data, methods, and tools (Part A).* Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

80 Strachan, L. L. et al. (2022). *A regional and international framework for evaluating seagrass management and conservation.* Marine Policy, 146, 105306. https://doi.org/10.1016/j.marpol.2022.105306.

National authorities should include specific measures for coastal wetland restoration in their national marine strategies and action plans, recognising its benefits not only for biodiversity support but also for coastal protection and climate regulation. Furthermore, in addition to the risk assessments foreseen by the MSFD, national plans and strategies can also consider the assessment of risks to coastal wetlands from activities in the marine environment and from the effect of seawater on coastal areas (e.g., marine intrusion, coastal aquifers salinisation, spread of marine invasive species). This approach can increase knowledge about coastal wetlands pressures and inform planning of restoration efforts. In this context, synergies with the National Restoration Plans should be pursued to ensure coordinated approach to coastal ecosystems restoration.

Positive practices of integrating coastal wetland restoration into national planning in the marine and coastal protection policy fields are found in Portugal and France (see below).

Examples of integrating coastal wetland restoration and conservation into national planning documents for marine and coastal protection

France

The **National Strategy for Integrated Coastline Management** (2012) was established to strengthen the resilience of coastal areas by drawing on the role of natural coastal environments. These ecosystems are valuable assets in mitigating the effects of natural phenomena, such as marine submersion, erosion, flooding, etc. Another key objective is to **protect and restore coastal ecosystems, e.g. wetlands, dune belts, mangroves, coral reefs**, which dissipate the sea´s energy and help limit the impact of coastal erosion on activities and property[81].

Portugal

The **Coastal Management Programmes** (POCs) are the instruments aiming to create the conditions for an integrated management of coastal areas. They frame the planning and management of the coastal resources, focusing on the protection and biophysical integrity of the space, the conservation of environmental and landscape values and the balanced sustainable development. POCs cover areas to include two buffer zones:

- The **terrestrial buffer zone** – a strip of land along the coastline, at least 500 m wide (from the shoreline (backshore) towards the hinterland). The width of the strip can reach 1000 m where this is deemed appropriate to protect coastal systems such as dunes, fossil cliffs, coastal lagoons, for example, and inherent dynamics.
- The **maritime buffer zone** – the water strip that goes from the limit of the foreshore up to the 30 m bathymetry line[82].

81 Ministère de la Mer. (n.d.). *Adaptation des territoires aux évolutions du littoral.* Ministère de la Mer. Available at: https://www.mer.gouv.fr/adaptation-des-territoires-aux-evolutions-du-littoral.

82 Cavaco, C. et al. (2021). *Spatial Planning and Regional Development in Portugal. Lisboa: Direção-Geral do Território.* Available at: https://www.researchgate.net/publication/360463808_Spatial_Planning_and_Regional_Development_in_Portugal.

The protection norms established by POCs cover:

- coastal risks prevention, for example, erosion of sandy soils or floods and wave over topping,
- natural assets protection by designating various areas and protection levels within these buffer zones,
- water resources management.

Key recommendations

→ Improve **links of coastal wetland restoration to CAP** through timely implementing GAEC2, using non-productive investments and eco-schemes to protect and restore wetlands in the agricultural landscape.

→ Introduce **(coastal) wetland restoration into FRMPs, RBMPs, and national marine strategies and action plans** as a cost-effective and multi-benefit measure for flood risk mitigation, water regulation and coastal protection.

Where to find more information

- **RESTORE4Cs Deliverable:** Policy analysis and policy demands for data, methods, and tools (Part A) (2024). Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance)[83].

83 Authors: Kampa, E., Bueb, B., Elkina, E., Otero, M.M., Abdul Malak, D., Schröder, C., Sanchez, A., Guelmami, A., Ronse, M., Kataržytė, M., Vaičiūtė, D., Bučas, M., Raoult, J., Speijer, F., Lillebø, A., Carvalho, T., Geamănaă, N., Cazacu, C., Racoviceanu, T., Camacho, A.

3.6 Governance, stakeholder participation and partnerships

3.6.1 Establish clear competences of public authorities on coastal wetland restoration

- → Which public authorities have competences on coastal wetland restoration and conservation at national and regional level in different policy fields?
- → Which public authorities have competences on policy, planning, monitoring, enforcement for coastal wetland restoration and conservation?
- → Are competences overlapping or unclear and can they be further improved to avoid conflicts?

Coastal wetlands are usually subject to the jurisdiction of various bodies and administrations. It is thus important to define clearly public authorities which are responsible for coastal wetland conservation and restoration and establish clear competences.

To identify needs for improvement in the governance setting, as a first step, the roles and duties on coastal wetland conservation and restoration across different governance levels and policy fields should be described and clarified:

- Both authorities in the national government and regional governments should be considered. At national level, the lead authority responsible for policy on coastal wetland restoration and conservation should be defined, and if there is more than one, the respective responsibilities clarified. At regional (sub-national) level, institutions responsible for restoration and conservation programmes on coastal wetlands should be identified. Furthermore, the general scope of responsibilities of coastal municipalities as local level stakeholders should also be defined.
- Authorities in the main relevant policy fields should be considered, namely authorities with competence in climate change mitigation & adaptation, nature & biodiversity, water management, as well as coastal/marine planning and management. Often wetlands are effectively represented within nature restoration and water management policy fields, but their climate change mitigation role is less adequately captured in the governance setting where no public bodies are specifically responsible for coastal wetlands.
- It should be clarified which public authorities at national, regional (sub-national), and, if relevant, local level are responsible for policy, planning, monitoring, enforcement in the field of coastal wetland restoration and conservation.

Because of the location of coastal wetlands encompassing both land and sea or, in some cases, crossing administrative boundaries, there may be jurisdiction overlap in the designation of responsibilities concerning their management, resulting in confusion and economic, political, and management challenges[84]. It is thus important to identify such overlapping or unclear

84 De Oliveira, M. et al. (2024). *Governance of coastal wetlands: Beyond the community conservation paradigm.* Ocean & Coastal Management, 255, 107253. https://doi.org/10.1016/j.ocecoaman.2024.107253.

responsibilities among institutions and across different governance levels on coastal wetland restoration and conservation and whether such an overlap results in conflicts. Identifying these conflicts and areas of overlapping or unclear competences lays the basis for improving governance effectiveness in coastal wetland restoration and conservation.

Support from RESTORE4Cs

To guide the identification of key public authorities responsible for coastal wetland restoration and conservation, a national policy assessment framework was used, which is presented in RESTORE4Cs Deliverable "Policy analysis and policy demands for data, methods, and tools". This framework helps to map key elements of national governance structures and policy instruments. This type of analysis draws on a review of relevant policy documents, literature, and expert knowledge. A structured policy template to carry out the mapping is provided in Annex 2.

The RESTORE4Cs Deliverable "Policy analysis and policy demands for data, methods, and tools" presents the overview of the national governance settings of six European countries (France, Lithuania, Portugal, Romania, Spain, and the Netherlands) highlighting national approaches and good practices. An example of a governance setting for (coastal) wetlands conservation in the Netherlands is presented below.

South-West Dutch Delta, Netherlands
Source: © RESTORE4Cs, University of Salento/LIFEWatch ERIC

Dutch governance setting for (coastal) wetlands conservation

At the national level, the responsibilities to restore and conserve wetlands are divided between different policy areas.

- The lead authority in the nature & biodiversity domain is the **Ministry of Agriculture, Nature and Food Quality**. Coastal wetlands fall under the "Netherlands Nature Network", the main ecological structure of existing and newly constructed nature reserves, also covering Natura 2000 sites. Designating a nature reserve as a Natura 2000 area is done with

a designation decision of this Ministry (specifically, the Minister for Nitrogen and Nature). The designation decision states which goals are pursued for a specific area, e.g., which plants and animals require protection. A management plan is then drawn up in close consultation with the parties involved and includes, *inter alia*, the measures required to achieve the goals[85].

- The **Ministry of Economic Affairs and Climate Policy** is the national policy-making authority responsible for climate change mitigation and adaptation. Under this Ministry, the Netherlands Enterprise Agency (RVO) is accountable, among other things, for assembling and providing the annual reports to the UNFCCC, including information on GHG emissions and removals from wetland ecosystems.
- The **Ministry of Infrastructure and Water Management** is the national policy-making authority responsible for managing water resources and mitigating flood risks, which includes the management of natural barriers against the sea, such as dunes or beaches. The natural barriers also provide habitats for coastal flora and fauna, and large parts of these areas are designated as wetlands under the Ramsar Convention[86]. Both natural coastal areas and "grey" solutions such as dikes, waterworks, and sea barriers, are considered for flood protection. Policy implementation is often delegated to the Directorate-General for Public Works and Water Management ("Rijkswaterstaat" or RWS) and Dutch Water Authorities.

The Ministry of Infrastructure and Water Management oversees the **National Delta Programme** led by the **Delta Programme Commissioner**, a high-level government official. The Delta Programme protects the Netherlands against high water and flooding, ensures sufficient quantities of fresh water, and contributes to climate-resilient and water-robust planning.

At the regional level, provinces are responsible for policymaking, planning, monitoring, and enforcement of wetland conservation as part of nature and biodiversity policies.

- Within climate change mitigation and adaptation domain, provinces are accountable for policymaking and planning activities.
- In the water domain of coastal wetland conservation, regional Water Boards ('Waterschappen') and regional branches of the RWS under the Ministry of Infrastructure and Water Management are responsible for policy making, planning, and monitoring. The enforcement is conducted by the regional Water Authorities only.

As a result, wetland-related responsibilities are well captured and divided between the various stakeholders. Wetlands are effectively represented within nature restoration and water management policy fields, but the climate change mitigation role of wetlands is less adequately captured. There are no public bodies specifically responsible for coastal wetlands.

85 Ramsar Convention Secretariat. (2022). *Wadden Sea, Ramsar Sites Information Service.* Available at: https://rsis.ramsar.org/ris/289.

86 Ramsar Convention Secretariat. (2023). The List of Wetlands of International Importance. Ramsar. Available at: https://www.ramsar.org/sites/default/files/documents/library/sitelist.pdf.

Key recommendations

- → **Clear definition and designation of coastal wetlands in the legislation** can support a clear governance setting for coastal wetlands.
- → Map and clearly describe **responsibilities of public authorities for coastal wetland restoration and conservation** at national, regional, and, if relevant, local levels, in different policy fields (climate, nature, water, coastal/marine) and for different competences (policy, planning, monitoring, enforcement).
- → **Identify overlapping jurisdictions and poorly defined competences**, to support conflict-resolution in the governance setting concerning planning and implementation of coastal wetlands restoration.

Where to find more information

- **RESTORE4Cs Deliverable:** Policy analysis and policy demands for data, methods, and tools (Part A) (2024). Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance)[87].

87 Authors: Kampa, E., Bueb, B., Elkina, E., Otero, M.M., Abdul Malak, D., Schröder, C., Sanchez, A., Guelmami, A., Ronse, M., Kataržytė, M., Vaičiūtė, D., Bučas, M., Raoult, J., Speijer, F., Lillebø, A., Carvalho, T., Geamănaă, N., Cazacu, C., Racoviceanu, T., Camacho, A.

3.6.2 Establish a governance structure that enables collaboration and trust between stakeholder and builds long-term commitment towards restoring wetlands

- → Which stakeholders may influence or be influenced by restoration?
- → Which stakeholders should be involved in the design of the restoration actions?
- → What methodologies can be used to identify, analyse and engage with stakeholders?
- → What are the best practices for building trust and long-term commitment for restoring wetlands?
- → How to consider the interests of local communities and integrate this knowledge with scientific data?

Large-scale restoration of coastal wetlands may often imply changes in land uses and in the spatial distribution of socioeconomic activities. Landscape modification touches many socio-cultural dimensions such as the identity, history, values, cultural knowledge and beliefs of local communities. For this reason, restoration may face opposition or be blocked by influential societal actors. Therefore, the early involvement of stakeholders or interested parties in the (co-) design, implementation and follow up, is a decisive component for the success and long-term sustainability of restoration projects[88,89,90].

Particularly, the sustainability of the restoration results over time often depends on the engagement and stewardship of **local communities**. Evidence shows that participatory management strategies, such as co-management and community-based management, are more successful than top-down, centralised approaches[91]. For this reason, a sustainable process to restore and re-shape the territory should foresee an inclusive participatory process, covering consultations with key stakeholders, informative meetings that are open to the public and an assessment of sectoral needs, besides ensuring public access to information on the state of the natural resources. This process should build trust among actors, foresee conflict resolution procedures, and support coordination and cooperation among stakeholders[92].

In the case of coastal wetlands, **public authorities in charge of Natura 2000 sites or national designated protected areas** should in close collaboration with river basin management autho-

88 Suarez, S. et al. (2025). *Guides and recommendations for scaling up of the solutions.* Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP2 – European (coastal) wetlands restoration Community of Practice (ECoP)).

89 Nelson, C. R. et al. (2024). *Standards of practice to guide ecosystem restoration: A contribution to the United Nations Decade on Ecosystem Restoration 2021–2030* (ISBN 978-92-5-138471-8). Food and Agriculture Organization of the United Nations; Society for Ecological Restoration; IUCN, Commission on Ecosystem Management. https://doi.org/10.4060/cc9106en.

90 Conservation Measures Partnership. (2025). *Open standards for the practice of conservation (Version 5.0).* Conservation Measures Partnership. Available at: https://www.conservationstandards.org/wp-content/uploads/2025/07/CMP-Open-Standards-Report-v5.0-FINAL-English-2025-06-26.pdf.

91 De Oliveira, M. et al. (2024). *Governance of coastal wetlands: Beyond the community conservation paradigm.* Ocean & Coastal Management, 255, 107253. https://doi.org/10.1016/j.ocecoaman.2024.107253.

92 Ibid.

rities encourage the establishment of participatory committees, which explicitly involve civil society organisations, academia and the private sector and are informed by best available science as well as local and cultural knowledge. The involvement of various stakeholder groups helps to ensure that a decision-making process is transparent and equitable[93] while reliance on scientific and other types of knowledge allows for a well-informed and socially acceptable restoration decision-making.

The involvement of **municipalities** in participatory processes should also be considered, given their potential role in informing and implementing blue carbon regulations. Municipalities are key actors in the management, protection, and restoration of blue carbon ecosystems. Their interest, however, often lies in the tangible co-benefits these ecosystems provide, such as tourism and coastal protection[94]. Therefore, if the area for coastal wetland restoration is selected and prioritised based on its potential benefits for coastal protection, climate change adaptation or biodiversity that support local tourism opportunities, the involvement of local municipalities is especially encouraged.

Finally, **non-governmental organisations (NGOs) and private institutions** can play a complementary role by filling gaps left by government agencies. When public institutions lack the capacity or resources to manage coastal wetlands effectively, these organisations can provide crucial support, expertise, and resources to sustain conservation and restoration efforts.

Support from RESTORE4Cs

In RESTORE4Cs, the engagement process on coastal wetland restoration was structured in three participatory ways: scoping interviews, participatory workshops and follow-up meetings. This mix of strategies for engaging with stakeholders allowed for different degrees of interaction, consultation and involvement. Learnings from this process are presented in the box below. For more information on the methods followed in RESTORE4Cs to collect stakeholders' preferences, please consult the section 3.4.2 "Assess benefits and costs of restoration actions for climate change mitigation".

Learnings from the RESTORE4Cs for developing inclusive participatory structures:

- Ensure a balanced representation of sectors, ensuring underrepresented groups are involved[95].
- Involve a 'neutral' actor or facilitator to build trust and value, to overcome intersectoral conflicts.

93 De Oliveira, M. et al. (2024). *Governance of coastal wetlands: Beyond the community conservation paradigm.* Ocean & Coastal Management, 255, 107253. https://doi.org/10.1016/j.ocecoaman.2024.107253.

94 Murphy, A. E. et al. (2023). *"Whose carbon is it?" Understanding municipalities role in blue carbon ecosystems management in Canada.* Nature-Based Solutions, 4, 100089. https://doi.org/10.1016/j.nbsj.2023.100089.

95 Conway, S. F. (2025). *Multi-Actor Inclusion and Stakeholder Engagement Checklist – PREMIERE Toolsheet (Technical note).* Zenodo. https://doi.org/10.5281/zenodo.15281085.

- Discuss real-life needs, use a direct and easy understandable language[96].
- Rather than treating stakeholders as passive receptors of information, engage them in decision-making through meaningful interactions and by assigning responsibilities.
- Identify leaders, entrepreneurs and personalities who can mobilise the community around environmental issues[97].
- Build on existing projects, events and opportunities allowing to sustain interactions as part of a consistent framework or vision, supported by short but regular interactions.
- Recognise and integrate 'tacit knowledge' (experience-based expertise developed by practitioners over generations).
- Develop new governance structures that sustain stakeholder and institutional commitment, while helping mobilise existing resources, raise new funds and communicate clear goals towards the local communities.

Furthermore, the **catalogue of 'Solutions'** available on the platform of the European Community of Practice for Restoring Wetlands aims to provide a set of inspiring case studies that illustrate how trust and support for wetland restoration have been built through a combination of factors: from local leadership to supporting policies, and more. Further below, an example of a collaborative governance system present in one of the pilot sites, the Camargue wetlands, France, is described.

Good practice example of collaborative governance system in the Camargue wetlands, France[98]

Camargue is a UNESCO "Man and Biosphere" Reserve, a Special Protection Area under the EU Natura 2000 network and a Ramsar site. It includes the oldest and one of the largest Nature Reserves in mainland France: the Camargue National Nature Reserve (established in 1927). The Regional Natural Park of Camargue covers an area of 85,000 ha, established in 1970.

96 EC, Directorate-General for Agriculture and Rural Development. (n.d.). *How can participatory methods enable communication and the embedding of the output from a multi-actor project?* EU CAP Network. Available at: https://eu-cap-network.ec.europa.eu/projects/practice-abstracts/how-can-participatory-methods-enable-communication-and-embedding-output_en.

97 Ostrom, E. (2011). *Background on the institutional analysis and development framework.* In M. Poteete, A. Janssen, & E. Ostrom, Working together: Collective action, the commons, and multiple methods in practice (pp. 7–27). Princeton University Press. Available at: https://idahoecosystems.org/sites/default/files/literature_resource/sustainable_social-ecological_systems_ostrom_2011.pdf.

98 Terrisse, A. et al. (2023). *Characterising governance landscape, based on Knowledge Sites experiences and key policies to devise a Theoretical Governance Framework for successful wetland restoration.* Deliverable. WaterLANDS project. Available at: https://planbleu.org/wp-content/uploads/2024/01/D3.1_Supportive-governance-and-policy.pdf.

Camargue, France
Source: © RESTORE4Cs, University of Salento/LIFEWatch ERIC

Main actors, roles and mutual relationship:

- The **Regional Natural Park of the Camargue** (site manager) is a public authority that is part of the national networks of regional parks. It is managed by a multidisciplinary team and its operation is based on open decision-making processes and regular consultation with the territory's stakeholders.
- The **Conservatoire du littoral**, the French national coastal protection agency, is a public administrative body under the Ministry of Ecological Transition and Territorial Cohesion, responsible for nature protection. It operates through ten regional delegations, with the Camargue falling under the Provence-Alpes Côte d'Azur delegation. The Conservatoire du littoral purchased the Camargue site with the main objective to move from salt production to wetland conservation.
- **Tour du Valat** is a private non-profit research institute for the conservation of Mediterranean wetlands, working in the public interest. It manages the restoration programme of the former saltworks of Camargue together with the National Society for Nature Protection (SNPN), the responsible authority for the Camargue Natural Reserve.
- The **Permanent Center of Initiatives for the Environment Rhône-Pays d'Arles** is a territorial strategic facilitator of the ecological transition. It cooperates and acts on a daily basis with the institutions, the inhabitants and all the actors of the territory. It is a member of a national network which federates 80 associative structures on the national territory.
- The **Water Agency (Agence de l'Eau Rhône-Méditerranée-Corse)** is a public authority under the Ministry of Ecological Transition and Territorial Cohesion, dedicated to the preservation of water. It is one of the main funders of restoration projects.

Decision-making process:

- Different governance systems are in place for wetland restoration in the Camargue region. For the former saltworks, the restoration process was put in place by the Regional Natural Park of the Camargue (coordinating manager) working in partnership with the Tour du Valat and the SNPN (co-managers) under the aegis of the Conservatoire du Littoral (landowner).

- A **restoration project committee** involving all categories of local stakeholders was created. It includes the landowner, the three site managers and the Centre Permanent d'Initiatives pour l'Environnement (CPIE) Rhône – Pays d'Arles, assisting with organising the consultations. The mayor of Arles, the Water Agency and local governmental actors are also involved.
- Since January 2021, the CPIE has been supporting the Conservatoire du littoral and the three site co-managers (the Camargue Regional Natural Park, the Tour du Valat, and the SNPN) as a **mediator and facilitator of consultations for developing a management plan**. It was tasked with engaging around 20 players in the area (representatives of hunting, fishing, breeding, site contractors, local associations, etc.) to integrate them into the management plan development. Once approved, the management plan will be in place for 10 years.
- Two main **Delta contracts** have been implemented in the Camargue region: the first focused on setting the ground for collaboration between different stakeholders, while the second dealt with concrete restoration activities, funded by the Water Agency.

Key recommendations

→ Perform an **extensive mapping** of the interested parties or stakeholders, taking into account all stakeholders that can influence or be influenced by restoration, including those located outside the boundaries of protected areas and considering the entire catchment or sub-catchment level.

→ Ensure the **participation of local communities, NGOs, academia and private actors**, alongside public authorities, for effective restoration and conservation of coastal wetlands through establishing participatory committees. Choose a mix of strategies for engaging with stakeholders, allowing for different degrees of interaction, consultation and involvement.

→ Ensure **diverse representation, multi-level and cross-sectoral cooperation and collaboration** of stakeholders.

→ Use learning from the RESTORE4Cs project to effectively develop participatory inclusive structures.

Where to find more information

- **RESTORE4Cs Deliverable:** Guides and recommendations for scaling up of the solutions[99] (2025). Available at: https://www.restore4cs.eu/about/workplan/ (under WP2 – European (coastal) wetlands restoration Community of Practice (ECoP)).

99 Authors: Suarez, S., Marangi, C.

3.6.3 Foster public-private partnerships

- → Which restoration options could attract private investment (e.g. via carbon credits to offset emissions)?
- → Where are public-private partnerships most feasible based on cost-effectiveness and ecosystem service benefits?
- → What role can national authorities play in creating enabling frameworks for public-private partnerships in wetland restoration?

Developing public-private partnerships (PPPs) is critical for scaling up (coastal) wetland restoration, especially in the face of limited public budgets and rising climate investment needs. While the public sector often initiates wetland restoration for biodiversity and regulatory compliance, private actors are increasingly interested in carbon markets, resilience co-benefits, and sustainable land use returns. PPPs offer a powerful way to leverage complementary strengths, distribute risk, and ensure long-term maintenance funding.

However, to be effective, PPPs require transparency, clear benefit-sharing models, and alignment with both climate and socio-economic objectives. Also, restoration projects on ecosystems, including wetlands, can be risky from the private investor's point of view given the nature of the activity, political risks, weak governance and uncertainty about the rate of return which can discourage investors. The public sector can create an enabling environment by providing incentives for conservation and supporting the development of new revenue streams[100].

Support from RESTORE4Cs

The following RESTORE4Cs results are relevant to the development of PPPs for coastal wetland restoration.

1. **Sustainable Finance Inventory**
   The RESTORE4Cs project identified types of financing tools applicable for restoring coastal wetlands, including those enabling PPPs (see section 3.4.3 on "Identify funding sources"). Specifically, the financing tools enabling PPPs include Revolving funds, Carbon finance (voluntary and compliance markets), Conservation endowments and/or PES.

2. **Abatement Cost Curves (ACCs)**
   The ACC analysis showed that peatland rewetting and wetland conversion can deliver GHG reductions at low cost (see section 3.4.2 on "Assess costs and benefits of restoration actions"). This is a key selling point for carbon credit markets.

3. **Multi-Criteria Analysis (MCA)**
   MCA results provide insights into local preferences (see section 3.4.2 on "Assess costs and benefits of restoration actions"), helping to tailor PPP approaches to socially accepted co-benefits (e.g., recreation, employment).

100 Ciravegna, E. (2025). *Beyond public funds: diversifying financing for wetland restoration*. Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/11/EN_Policy-Brief-4.pdf.

There are several risks and uncertainties that need to be considered with regard to PPPs:

- **Market volatility:** Carbon prices and investor interest may fluctuate, reducing long-term financial predictability.
- **Equity concerns:** Without safeguards, PPPs may prioritize profitable areas over those with higher social or ecological needs.
- **Complexity:** Structuring PPPs requires legal expertise, monitoring systems, and long timeframes.

Valencian Wetlands, Spain
Source: © RESTORE4Cs, University of Salento/LIFEWatch ERIC

Good practice case: Private Corporate Social Responsibility Engagement in Marjal dels Moros (Spain)

In the Marjal dels Moros pilot site of RESTORE4Cs, private companies such as Parc Sagunt and Saggas contributed to coastal wetland restoration activities including stormwater management and birdwatching infrastructure. These contributions were driven by a combination of CSR goals, impact mitigation, and public visibility. The case of Marjal dels Moros illustrates how targeted local partnerships, when aligned with environmental goals, can unlock private co-funding, even in the absence of traditional market mechanisms.

Key recommendations

- → **Foster collaborations** between the public sector and private investors to co-fund and scale restoration projects, especially where climate change mitigation efforts can provide economic returns through carbon credits or other ecosystem services.
- → **Explore diverse financing instruments:** Tools such as green bonds, biodiversity credits, or CSR-linked partnerships with sectors like tourism or water utilities offer promising avenues for PPPs.
- → **Promote enabling environments for PPPs** by linking wetland restoration to climate finance mechanisms and setting clear eligibility standards. Use these financing instruments to de-risk private investments, especially in areas with high carbon abatement potential.

- **Integrate ACC data into investment catalogues** or restoration project pipelines to attract private carbon finance, aligning this with national climate targets and environmental, social and governance (ESG) investment frameworks.
- **Promote pilot PPPs** to build trust, demonstrate feasibility, and attract replication across regions.
- **Align interests for success:** Private engagement is more likely when there is clear alignment between restoration goals and corporate interests, such as regulatory compliance, risk mitigation, or reputational benefits (e.g., CSR initiatives).
- **Develop enabling frameworks:** The lack of market-based finance mechanisms (e.g., PES, biodiversity offsets, eco-tourism investments) reflects regulatory and capacity gaps that must be addressed.
- **Design for private engagement from the start:** Future projects should embed private sector roles early through co-funding arrangements, tax incentives, or benefit-sharing schemes that link ecosystem health to business value.
- **Create intermediary structures:** Facilitate private investment by establishing governance models or institutions that can de-risk investment (e.g. through guarantees), translate ecosystem benefits into investable metrics, build trust between public, private, and civil society actors.
- **Leverage local impact incentives:** Cases like Marjal dels Moros show that companies may contribute when local environmental improvements (e.g. pollution reduction, public infrastructure) also serve their own operational or branding goals.
- **Strengthen financial innovation capacity:** Many restoration initiatives lack experience with blended finance and need support in structuring investment-ready projects.
- **Avoid unchecked private influence:** Private involvement without clear boundaries may create tension with communities; projects should ensure public interest remains central.

Where to find more information

- **RESTORE4Cs Deliverable:** Report on cost/benefit analysis of wetland restoration options and on financing tools (2025)[101]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).
- **RESTORE4Cs Deliverable:** Report on the assessment of co-benefits and economic valuation of ecosystem services provision (2025)[102]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).
- **RESTORE4Cs Policy Brief No. 4:** Beyond public funds: diversifying financing for wetland restoration (2025)[103].

101 Authors: Anglada, C., Massoutier, J., Lago, M., Ciravegna, E., Raoult, J., Polman, N., Bodivit, A., Sella, L., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Bučas, M., Beekman, V., Geamana, N., Giuca, R.C., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M.J., Morant, D., Rota, F.S., Štrbenac, A., Oliveira, B., Lillebø, A.

102 Author: Authors: Oliveira, B., Nogueira, A., Lillebø, A.

103 Author: Ciravegna, E.

3.7 Enabling capacities and raising awareness

The planning of coastal wetland restoration depends not only on sound science and policy, but also on the capacity of institutions, stakeholders, and the wider public to support these efforts. Often, the understanding of values that coastal wetlands and their restoration deliver is lacking among the broader public and decision-makers. This gap leads to undervaluing wetlands compared with competing land uses, making restoration projects more difficult to justify, fund, or implement.

RESTORE4Cs research identified a low awareness and limited knowledge of climate change mitigation potential and benefits of restored coastal wetlands among local stakeholders. This affects the social acceptance of restoration actions and, hence, their overall viability[104]. This indicates the need for stronger engagement, trainings opportunities, and wider information dissemination among local actors. In this context, it is important to provide a broader perspective and to communicate about benefits of restoration holistically, rather than focusing solely on climate change mitigation, to achieve a higher level of stakeholder mobilisation.

Strengthening capacity, e.g., through training and resource allocation, helps ensure that organisations can plan, manage, and monitor restoration effectively. Training sessions, built on the latest scientific knowledge and addressing key knowledge gaps in a clear and structured way, serve as important communication tool in coastal wetland restoration, creating opportunities for knowledge exchange, capacity building, and collaborative learning among stakeholders. Likewise, raising awareness, including among local communities, landowners, industry, decision-makers, builds trust and encourages shared stewardship of restored areas. Building such capacities and raising awareness is a key pillar of a national strategy or roadmap for coastal wetland restoration.

Communication and dissemination activities play an important role in increasing the visibility of the restoration project results, using clear and accessible language, raising awareness and supporting engagement of stakeholders and creation of new partnerships. When tailored to the specifics of each target audience, communication helps connect science with the broader public, building social license, and support evidence-based policy. As part of the RESTORE4Cs project, a video documentary series was created, focusing on six cases of coastal wetland restoration and building on extensive stakeholder interviews and local research. Stakeholder insights gathered during this process helped to shape the RESTORE4Cs Community of Practice as well as methods to evaluate social acceptability of restoration and management approaches.

104 Sella, L. et al. (2025). *Social acceptability of wetland restoration and management.* Deliverable. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Key recommendations

- → **Improve communication on and raise awareness of the ecological importance of coastal wetlands**, their value in ensuring social and economic sustainability of local communities and their role in biodiversity conservation, carbon storage, disaster risk reduction and climate adaptation (wetland restoration as key investment in resilience).
- → **Demonstrate effectiveness** of coastal wetlands in addressing societal challenges and their **value for money**.
- → **Involve communities, engage local actors directly** and show case real-world examples of co-benefits.
- → **Link coastal wetlands recovery to improvements in life quality** of general public.
- → **Organise targeted trainings** to build capacities and improve the understanding and knowledge of benefits of coastal wetland restoration, especially with relation to climate change mitigation potential and benefits of restoration.

Where to find more information

- **RESTORE4Cs Deliverable:** Social acceptability of wetland restoration and management (2025)[105]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, eco-logic, and economic valuation for enhanced co-benefits from wetland restoration).
- **RESTORE4Cs Video Documentaries** about six pilot sites. Available at: https://www.lifewatching.tv/tv-show/restore4cs/.

105 Authors: Sella, L., Rota, F. S., Pollo, N., Vivaldo, G., Anglada, C., De Fusco, G., Ciravegna, E., Massoutier, J., Bodivit, A., Khavandgaran, S., Omidmand, M., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Beekman, V., Polman, N., Raoult, J., Giuca, R. C., Geamana, N., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M. J., Morant, D., Štrbenac, A., Lillebø, A., Sousa, A., Coelho, P., Oliveira, B.

04

Summary of recommendations on the use of RESTORE4Cs methods and tools to prepare a national roadmap for coastal wetland restoration

This implementation roadmap is intended to help national authorities and stakeholders in developing a national strategy on coastal wetland restoration and gives guidance on how to use tools and results of the RESTORE4Cs project to improve the planning of coastal wetland restoration. The recommendations formulated throughout this roadmap aim to target specific actions that can be undertaken to define priorities for coastal wetland restoration and contribute to the achievement of key policy targets for climate and biodiversity.

The main recommendations can be summarised as follows:

1. Identify and rank **key implementation challenges** for coastal wetland restoration to set priorities for solutions and recommendations to be elaborated in a national roadmap or strategy for restoring coastal wetlands.

2. Ensure that a **clear and operational definition of coastal wetlands** is formally embedded in national legislation, providing a legal basis for consistent assessments, restoration prioritisation, and compliance with EU policy obligations.

3. Use **best available scientific knowledge**, including the European Coastal Wetlands Interactive Platform and Extent and Condition Assessment Tool to establish a national baseline for coastal wetland area, type distribution, and protection coverage and to assess pressures and conditions of coastal wetland habitats.

4. Integrate **policy outcome indicators into national wetland strategies** to systematically monitor progress in wetland restoration and condition. Optimise and refine indicators by combining those already in use with the policy outcome indicators developed under RESTORE4Cs, to assess changes in wetland ecological status, resilience, and contributions to climate and biodiversity policy targets.

5. Use the Spatial Decision-Support Toolbox developed under RESTORE4Cs to **identify high-impact restoration zones for coastal wetlands**, where ecological, climatic and socio-economic co-benefits align. The Spatial Decision-Support Toolbox outputs can be integrated into national wetland strategies and National Restoration Plans, ensuring restoration priorities are grounded in spatially explicit, evidence-based assessments.

6. **Use coastal wetland restoration as a nature-based solution for climate change mitigation.** Restoration actions which restore natural hydrology, morphology, vegetation, water quality or land use in the catchment offer higher potential for GHG reductions and/or carbon storage. At the same time, restoration actions need to be specific to the type of wetland and consider potential short- and medium-term trade-offs, such as temporarily increased methane emissions resulting from vegetation restoration or anoxic conditions created by re-flooding.

7. **Engage actively with stakeholders for the development of a national roadmap or strategy for coastal wetland restoration.** The engagement of stakeholders brings added value in different steps of planning restoration for coastal wetlands:

    - Knowledge of stakeholders can be valuable already at the baseline assessment in terms of identifying key implementation challenges and focusing roadmap development on selected priority issues.
    - Stakeholders should be engaged when applying criteria for the prioritisation and site selection for coastal wetlands restoration.
    - Stakeholders also bring in site-specific expertise and knowledge for selecting suitable restoration actions for specific coastal wetlands, assessing costs and benefits and evaluating societal preferences for different restoration scenarios.

8. **Increase public awareness of and improve knowledge** about the climate change mitigation potential of coastal wetland restoration and associated benefits among local stakeholders. Use tailored communication and training approaches to reach the target audience and improve social acceptance of coastal wetland restoration actions to support long-term sustainability of restoration outcomes. Encourage participation of relevant stakeholders in the European Community of Practice for Wetland Restoration to enhance capacity-building, facilitate knowledge exchange, and foster collaboration throughout the implementation process.

References

Abdul Malak, D., Marin, A.I., Trombetti, M. & San Roman, S. (2021). Carbon pools and sequestration potential of wetlands in the European Union. European Topic Centre on Urban, Land and Soil Systems. Vienna and Malaga, ISBN 978-3-200-07433-0.

Airoldi, L., & Beck, M.W. (2007). Loss, status and trends for coastal marine habitats of Europe. Oceanography and Marine Biology, 45, 345-405.

ALFAwetlands. (2025). ALFAwetlands – wetland restoration for the future. ALFAwetlands project. Available at: https://alfawetlands.eu/.

Camacho, A., Manzano, M., de la Hera, A., Farr, G., Lewis, A., Marti-Cardona, B., Prem, M., Prichard, D., Russi, D., Stephan, R., Whiteman, M., Bayari, S., Bonacci, O., Djabri, L., Droubi, A., Fadl, A., Gaalouli, N., Kiri, E., Laftouhi, N.E., Mateljak, Z., Qahman, K.A., Shaban, A., Salem, O., Radojevic, D. & Zouari, K. (2019). Management and protection of Mediterranean groundwater-related coastal wetlands and their services. United Nations Educational, Scientific and Cultural Organization (UNESCO). Paris, 137 pp.

Cavaco, C., Mourato, J., Costa, J.P., Pereira, A., Vilares, E., Moreira, P. & Magalhães, M. (2021). Spatial Planning and Regional Development in Portugal. Lisboa: Direção-Geral do Território. Available at: https://www.researchgate.net/publication/360463808_Spatial_Planning_and_Regional_Development_in_Portugal.

Conservation Measures Partnership. (2025). Open standards for the practice of conservation (Version 5.0). Conservation Measures Partnership. Available at: https://www.conservationstandards.org/wp-content/uploads/2025/07/CMP-Open-Standards-Report-v5.0-FINAL-English-2025-06-26.pdf.

Conway, S. F. (2025). Multi-Actor Inclusion and Stakeholder Engagement Checklist – PREMIERE Toolsheet (Technical note). Zenodo. https://doi.org/10.5281/zenodo.15281085.

De Oliveira, M., Morrison, T., O'Brien, K. R., & Lovelock, C. E. (2024). Governance of coastal wetlands: Beyond the community conservation paradigm. Ocean & Coastal Management, 255, 107253. https://doi.org/10.1016/j.ocecoaman.2024.107253.

Doherty, T. S., Bland, L. M., Bryan, B. A., Neale, T., Nicholson, E., Ritchie, E. G., & Driscoll, D. A. (2018). Expanding the Role of Targets in Conservation Policy. Trends in ecology & evolution, 33(11), 809–812.

Duwe, M., Graichen, J. & Böttcher, H. (2023). Can current EU climate policy reliably achieve climate neutrality by 2050? Post-2030 crunch issues for the move to a net zero economy. Berlin: Ecologic Institute, Oeko-Institut. Available at: https://www.ecologic.eu/sites/default/files/publication/2023/2157-EU-climate-policy-post-2030-discussion-paper-web.pdf.

European Commission, Directorate-General for Agriculture and Rural Development. (n.d.). How can participatory methods enable communication and the embedding of the output from a multi-actor project? EU CAP Network. Available at: https://eu-cap-network.ec.europa.eu/projects/practice-abstracts/how-can-participatory-methods-enable-communication-and-embedding-output_en.

IUCN. (2021). Manual for the creation of Blue Carbon projects in Europe and the Mediterranean, Otero, M. (Ed) 144 pp.

Junta de Andalucía. (2021). Andalusian Climate Action Plan 2021-2030 (Decree 234/2021). Junta de Andalucía. Available at: https://www.juntadeandalucia.es/boja/2021/587/1.

LIFE Blue Natura. (n.d.). Home. LIFE Blue Natura. Available at: https://life-bluenatura.eu/en/home/.

Macreadie, P. I., Anton, A., Raven, J. A., Beaumont, N., Connolly, R. M., Friess, D. A., Kelleway, J. J., Kennedy, H., Kuwae, T., Lavery, P. S., Lovelock, C. E., Smale, D. A., Apostolaki, E. T., Atwood, T. B., Baldock, J., Bianchi, T. S., Chmura, G. L., Eyre, B. D., Fourqurean, J. W., . . . Duarte, C. M. (2019). The future of Blue Carbon science. Nature Communications, 10(1), 3998. https://doi.org/10.1038/s41467-019-11693-w.

Maes, J., Teller, A., Erhard, M., Conde, S., Vallecillo Rodriguez, S., Barredo Cano, J. I., Paracchini, M.-L., Abdul Malak, D., Trombetti, M., Vigiak, O., Zulian, G., Addamo, A., Grizzetti, B., Somma, F., Hagyo, A., Vogt, P., Polce, C., Jones, A., Marin, A., Ivits, E., Mauri, A., Rega, C., Czucz, B., Ceccherini, G., Pisoni, E., Ceglar, A., De Palma, P., Cerrani, I., Meroni, M., Caudullo, G., Lugato, E., Vogt, J., Spinoni, J., Cammalleri, C., Bastrup-Birk, A., San-Miguel-Ayanz, J., San Román, S., Kristensen, P., Christiansen, T., Zal, N., De Roo, A., De Jesus Cardoso, A., Pistocchi, A., Del Barrio Alvarellos, I., Tsiamis, K., Gervasini, E., Deriu, I., La Notte, A., Abad Viñas, R., Vizzarri, M., Camia, A., Robert, N., Kakoulaki, G., Garcia Bendito, E., Panagos, P., Ballabio, C., Scarpa, S., Montanarella, L., Orgiazzi, A., Fernandez Ugalde, O., & Santos-Martín, F. (2020). Mapping and assessment of ecosystems and their services: An EU ecosystem assessment. Publications Office of the European Union, Luxembourg. Available at: https://data.europa.eu/doi/10.2760/757183 (JRC120383).

MARCO. (2016). Analysis for the Mid-Atlantic Regional Council on the Ocean (MARCO) to support a Framework for prioritizing wetlands as Natural and Nature-Based Features for Climate Risk Reduction and Resilience. Environmental Law Institute. Available at: https://www.eli.org/sites/default/files/files-pdf/Targeting-Conservation-and-Restoration-in-the-MARCO-Region-Final-Report-December-2016.Cover_.pdf.

McDonald, H., Seeger, I., Lago, M., & Scholl, L. (2023). Synthesis report on sustainable financing of the establishment of ponds and pondscapes. PONDERFUL Project (EU Horizon 2020 GA no. ID869296), Deliverable 1.4. Available at: https://www.ecologic.eu/sites/default/files/publication/2023/33005-D1_4-Sustainable-Financing.pdf.

Mcleod, E., Chmura, G. L., Bouillon, S., Salm, R., Björk, M., Duarte, C. M., Lovelock, C. E., Schlesinger, W. H., & Silliman, B. R. (2011). A blueprint for blue carbon: toward an improved understanding of the role of vegetated coastal habitats in sequestering CO_2. Frontiers in Ecology and the Environment, 9(10), 552–560. https://doi.org/10.1890/110004.

Ministère de la Mer. (n.d.). Adaptation des territoires aux évolutions du littoral. Ministère de la Mer. Available at: https://www.mer.gouv.fr/adaptation-des-territoires-aux-evolutions-du-littoral.

Ministry of Ecological Transition. (2022). 4th National Wetlands Plan 2022-2026. Ministry of Ecological Transition. Available at: https://www.var.gouv.fr/contenu/telechargement/17928/134101/file/plan_national_milieux_humides_2022-2026.pdf.

Misteli, B., Morant, D., Camacho, A., Adamo, M., Bachi, G., Bègue, N., Bučas, M., Cabrera-Brufau, M., Carballeira, R., Cavalcante, L., Cazacu, C., Coelho, J. P., Doebke, C., Dinu, V., Guelmami, A., Giuca, R., Kataržytė, M., Lillebø, A. I., Marin, A. I., … Attermeyer, K. (2025, November 16). Coastal wetland restoration and greenhouse gas pathways: A global meta-analysis [Preprint]. EarthArXiv. https://doi.org/10.31223/X51B39.

Morant, D., Picazo, A., Rochera, C., Santamans, A.C., Miralles-Lorenzo, J., Camacho-Santamans, A., Ibañez, C., Martinez-Eixarch, M. & Camacho, A. (2020). Carbon metabolic rates and GHG emissions in different wetland types of the Ebro Delta. PLoS ONE 15(4): e0231713. https://doi.org/10.1371/journal.pone.0231713.

Murphy, A. E., Sherren, K., Frank, B. & Saunders, S. (2023). "Whose carbon is it?" Understanding municipalities role in blue carbon ecosystems management in Canada. Nature-Based Solutions, 4, 100089. https://doi.org/10.1016/j.nbsj.2023.100089.

Nelson, C. R., Hallett, J. G., Romero Montoya, A. E., et al. (2024). Standards of practice to guide ecosystem restoration: A contribution to the United Nations Decade on Ecosystem Restoration 2021–2030 (ISBN 978-92-5-138471-8). Food and Agriculture Organization of the United Nations; Society for Ecological Restoration; International Union for Conservation of Nature, Commission on Ecosystem Management. https://doi.org/10.4060/cc9106en.

Oliveira et al. (submitted): Assessing Pressure Levels of a Wetland using the LUPLES model: Data sources and policy objectives perspective. Earth System Governance.

Ostrom, E. (2011). Background on the institutional analysis and development framework. In M. Poteete, A. Janssen, & E. Ostrom, Working together: Collective action, the commons, and multiple methods in practice (pp. 7–27). Princeton University Press. Available at: https://idahoecosystems.org/sites/default/files/literature_resource/sustainable_social-ecological_systems_ostrom_2011.pdf.

PONDERFUL. (n.d.). Home. PONDERFUL. Available at: https://ponderful.eu/.

Ramsar Convention Secretariat. (2022). Wadden Sea. Ramsar Sites Information Service. Available at: https://rsis.ramsar.org/ris/289.

Ramsar Convention Secretariat. (2023). The List of Wetlands of International Importance. Ramsar. Available at: https://www.ramsar.org/sites/default/files/documents/library/sitelist.pdf.

Ramsar Convention. (1971). Convention on Wetlands of International Importance especially as Waterfowl Habitat. Ramsar, Iran. Available at: https://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf.

Remote Sensing Solutions (Germany). (2025). Wetland Use Intensity (WUI) Dataset for European Wetlands in coastal zones (Version 2023) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.17660102.

Rochera, C., Picazo, A., Morant, D., Miralles-Lorenzo, J., Sánchez-Ortega, V., & Camacho, A. (2025). Linking carbon fluxes to flooding gradients in sediments of Mediterranean wetlands. ACS ES&T Water 5(6): 2882-2890. https://doi.org/10.1021/acsestwater.4c00940.

Ryfisch, S., Seeger, I., McDonald, H., Lago, M., & Blicharska, M. (2023). Opportunities and Limitations for Nature-Based Solutions in EU Policies—Assessed with a Focus on Ponds and Pondscapes. Land Use Policy, 135, 106957.

Strachan, L. L., Lilley, R. J., & Hennige, S. J. (2022). A regional and international framework for evaluating seagrass management and conservation. Marine Policy, 146, 105306. https://doi.org/10.1016/j.marpol.2022.105306.

Terrisse, A., Karner, M., & Dubreuil, C. (2023). Characterising governance landscape, based on Knowledge Sites experiences and key policies to devise a Theoretical Governance Framework for successful wetland restoration. Deliverable. WaterLANDS project. Available at: https://planbleu.org/wp-content/uploads/2024/01/D3.1_Supportive-governance-and-policy.pdf.

UNEA. (2022). Nature-based solutions for supporting sustainable development. United Nations Environment Resolution UNEP/EA.5/Res.5. Available at: https://wedocs.unep.org/rest/api/core/bitstreams/4caa2911-37ea-4915-b378-d2c2d525ee35/content.

WET HORIZONS. (2025). About WET HORIZONS. WET HORIZONS project. Available at: https://www.wethorizons.eu/about/.

Wetlands4Climate. (n.d.) Wetlands as Carbon Sinks. Wetland4Climate LIFE Project. Available at: https://fundacionglobalnature.org/wetlands4climate/en/inicio-english/.

RESTORE4Cs Products

Policy Briefs:

Abdul Malak, D., Sánchez-Espinosa, A., Otero, M.M., & Schröder, C. (2025). Advancing a coherent framework for assessing European coastal wetland condition. Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-8-v5_Final.pdf.

Ciravegna, E. (2025). Beyond public funds: diversifying financing for wetland restoration. Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/11/EN_Policy-Brief-4.pdf.

Guelmami, A. (2025). Advancing Evidence-Based Prioritisation for Coastal Wetland Restoration in Europe: The RESTORE4Cs Spatial Decision-Support Toolbox. Policy Brief. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-10-v4_Final.pdf.

Kampa, E., Elkina, E., & Otero, M. (2025). Unlocking potential of coastal wetlands in Europe: Integration into National Restoration Plans. Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-2_EN.pdf.

Misteli, B., Attermeyer, K., Rochera, C., Lilebø, A., & Camacho, A. (2025). How can coastal wetland restoration mitigate climate change? What we know and what is still unclear. Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-9-v7_Final.pdf.

RESTORE4Cs. (2025). Fostering inclusive and cross-sectoral action for wetlands: Building a Community of Practice supporting Ramsar Convention on Wetlands Resolution XIV.17. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/10/Policy-Brief_3_EN-3.pdf.

Otero, M. M., Abdul Malak, D., Sanchez A., Schröder, C., Kampa, E., Bueb B., Elkina, E., Guelmami, A., Camacho, A., Marangui, C., & Lillebø, A. (2025). European Coastal Wetland Indicators: A proposal for monitoring policy process across space and time. Policy brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-6-v2_Final.pdf.

Otero, M., Camacho, A., Abdul Malak, D., Kampa, E., Scheid, A., & Elkina, E. (2024). How can coastal wetlands help achieve EU climate goals? Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

Deliverables:

Anglada, C., Massoutier, J., Lago, M., Ciravegna, E., Raoult, J., Polman, N., Bodivit, A., Sella, L., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Bučas, M., Beekman, V., Geamana, N., Giuca, R.C., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M.J., Morant, D., Rota, F.S., Štrbenac, A., Oliveira, B., & Lillebø, A. (2025). Report on cost/benefit analysis of wetland restoration options and on financing tools. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Brand, A., Franke, J., Guelmami, A., Bègue, N., Adamo, M.P., Otero, M.M., Schröder, C. (2024). Methodological description of information layers (2024). Available at: https://www.restore4cs.eu/about/workplan/ (under WP6 – Upscaling and integration for assessment of the status and restoration potential of wetlands in Europe).

Kampa, E., Bueb, B., Elkina, E., Otero, M.M., Abdul Malak, D., Schröder, C., Sanchez, A., Guelmami, A., Ronse, M., Kataržytė, M., Vaičiūtė, D., Bučas, M., Raoult, J., Speijer, F., Lillebø, A., Carvalho, T., Geamănaă, N., Cazacu, C., Racoviceanu, T., & Camacho, A. (2025). Policy analysis and policy demands for data, methods, and tools (Part A). Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

Misteli, B., Attermeyer, K., Minaudo, C., von Schiller, D, Obrador, B., Abdul Malak, D., Sánchez, A., Coelho, J.P., Sousa, A., Morant, D., Rochera, C., Vaičiūtė, D., Kataržytė, M., Bučasm, M., Petkuvienė, J., Čerkasova, N., Guelmami, A., Anglada, C., Lago, M., Walles, B., Cazacu, C., & Camacho, A. (2023). Case Pilots overview and context setting. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP4 – Climate mitigation services and C and GHG processes in wetlands).

Morant, D., Picazo, A., Rochera, C., Camacho, A., Cabrera, M. & Attermeyer, K. (2025). Report on the key wetland restoration actions. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Oliveira, B., Nogueira, A., & Lillebø, A. (2025). Report on the assessment of co-benefits and economic valuation of ecosystem services provision. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Otero M.M., Abdul Malak, D., Sanchez, A., Schröder, C., Kampa, E., Bueb, B., Elkina, E., Guelmami, A., Ronse, M., Kataržytė, M., Vaičiūtė, D., Bučas, M., Speijer, F., Lillebø, A., Germana, N., Camacho, A., Suarez, S., Speijer, F., & Polman, N. (2024). Policy analysis and policy demands for data, methods, and tools (Part B). Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

RESTORE4Cs. (2025). Upscaling Potentially Restorable Wetland maps at the pan-European level. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP6 – Upscaling and integration for assessment of the status and restoration potential of wetlands in Europe).

Sella, L., Rota, F. S., Pollo, N., Vivaldo, G., Anglada, C., De Fusco, G., Ciravegna, E., Massoutier, J., Bodivit, A., Khavandgaran, S., Omidmand, M., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Beekman, V., Polman, N., Raoult, J., Giuca, R. C., Geamana, N., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M. J., Morant, D., Štrbenac, A., Lillebø, A., Sousa, A., Coelho, P., & Oliveira, B. (2025). Social acceptability of wetland restoration and management. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Suarez, S. & Marangi, C. (2025). Guides and recommendations for scaling up of the solutions. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP2 – European (coastal) wetlands restoration Community of Practice (ECoP)).

Annex 1: Screening for key implementation challenges of coastal wetland restoration

Table 9: Screening template for key implementation challenges of coastal wetland restoration.

	Potential challenges for implementing coastal wetland restoration (generic list)	Is this an important challenge in your country?	Scale of importance: 1 Very Important 2 Important 3 Less important
Policy coherence and governance	Lack of coherence between environmental and priorities from other sectors	Y/N. Explain:	1/2/3
	Lack of coherence between legal frameworks and planning policies at different levels (EU-national-local)	Y/N. Explain:	1/2/3
	Lack of binding restoration targets for wetlands	Y/N. Explain:	1/2/3
	Administrative bodies with unclear mandates	Y/N. Explain:	1/2/3
	Slow administrative processes	Y/N. Explain:	1/2/3
	Lack of coordination between authorities	Y/N. Explain:	1/2/3
	Transboundary governance coordination	Y/N. Explain:	1/2/3
	Lack of policy instruments which enable restoration	Y/N. Explain:	1/2/3
Quality and quantity of data	Poor delineation of wetlands	Y/N. Explain:	1/2/3
	Lack of data on coastal wetland status	Y/N. Explain:	1/2/3
	Lack of data on GHG-fluxes of coastal wetlands	Y/N. Explain:	1/2/3
	Limited evaluation and Monitoring	Y/N. Explain:	1/2/3
	Incomplete set of indicators for coastal wetland	Y/N. Explain:	1/2/3
	Lack of data on benefits from restoration	Y/N. Explain:	1/2/3
Knowledge and capacity	Technical expertise on restoration techniques	Y/N. Explain:	1/2/3
	Expertise to assess climate and other co-benefits	Y/N. Explain:	1/2/3
	Knowledge on environmental threats	Y/N. Explain:	1/2/3
	Lack of enforcement capacity	Y/N. Explain:	1/2/3
	Financing/funding	Y/N. Explain:	1/2/3
	Opportunity costs (sufficient compensation for agriculture, urban development, or industrial uses)	Y/N. Explain:	1/2/3
	Lack of effective knowledge exchange	Y/N. Explain:	1/2/3

Planning and prioritisation of restoration	Prioritisation of restoration areas	Y/N. Explain:	1/2/3
	Uncertainty about long-term results	Y/N. Explain:	1/2/3
	Mismatch between organisational planning timelines and the time required for ecosystem recovery	Y/N. Explain:	1/2/3
	Conflicting land uses	Y/N. Explain:	1/2/3
	Property rights/private lands	Y/N. Explain:	1/2/3
	Economic and social challenges for communities depending on more intensive wetland exploitation	Y/N. Explain:	1/2/3
Stakeholder engagement and awareness	Engagement with stakeholders in the restoration areas	Y/N. Explain:	1/2/3
	Communication between stakeholders (e.g., between planners and scientists)	Y/N. Explain:	1/2/3
	Voluntary participation from landowners	Y/N. Explain:	1/2/3
	Lack of time and resources available for sufficient co-creation processes	Y/N. Explain:	1/2/3
	Negative perception and low acceptance of wetland restoration	Y/N. Explain:	1/2/3
	Lack of awareness-raising activities	Y/N. Explain:	1/2/3
Other		Y/N. Explain:	1/2/3

Annex 2: Structured national policy analysis template

Template for national policy analysis on coastal wetlands restoration and conservation for climate mitigation and other co-benefits:

Objectives of template:

- To **gather detailed information on national policies, elements of the legal and regulatory framework, and institutional governance** for coastal wetland restoration in the six European countries (France, Spain, Portugal, the Netherlands, Romania, Lithuania) of RESTORE4Cs case pilots.
- To **improve the understanding of the strengths and limitations** of national policies as well their cross-linkages with EU and international policies for restoring wetland ecosystems for climate mitigation and key co-benefits.
- To **draw lessons learnt from the implementation of national policy frameworks** for coastal wetland restoration as climate mitigation strategy.

How to fill in the template:

- For each question, it is important that you **include references to the relevant documents**, whether these are legislative documents, plans, strategies, other publications, etc. References should be included *with links* in each instance. These can be included directly following responses to the question, within the table.
- Please **provide specific paragraphs/articles** of a law/policy with relevance to template questions (e.g. policy text on restoration objectives and targets etc.).
- Also please **clearly indicate** in each row **if information cannot be found**.

Definition of key terms:

- **Coastal wetlands:** The term is broadly used to describe areas of saltwater and freshwater wetlands located within coastal watersheds.[106] They include areas with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres (Ramsar Convention). In these areas, the water is the main controlling factor of the environment and the plant and animal life associated with it. Wetlands occur where the water table is on or near the earth's surface or where the land is covered by shallow waters (Ramsar Convention Preamble).

  The most conspicuous components of wetland types found in European coastal watersheds include vegetated environments such as salt marshes, intertidal seagrasses and freshwater marshes as well as unvegetated tidal flats (mudflats) and creeks. They develop under the influence of regular or occasional flooding by tides, including astronomical and wind-driven tides in coastal lagoons, estuaries and other transitional waters, fjords and sea lochs as well as embayments. In areas where tidal flooding is intermittent, other natural wetland habitats such as saltpans can also form under high salinity conditions.[107]

106 This template only refers to coastal wetlands in continental Europe and hence excludes coastal ecosystems in the EUs outermost regions (mangroves etc.).

107 This definition is based on Res. VI.5 and VII.11. Ramsar Classification System for Wetland Type (ramsar.org), the European Red List of Habitats and the wetland definition by the Intergovernmental Panel on Climate Change (IPCC).

- **Restoration:** The process of actively or passively assisting the recovery of an ecosystem in order to improve its structure and functions with the aim of conserving or enhancing bio-diversity and ecosystem resilience. The restoration of ecosystems can be done through improving the condition of a habitat type, its re-establishment in a favourable reference area and through improving the quality and quantity of a habitat of a species (based on definitions in the EU Nature Restoration Regulation).
- **Conservation:** The protection, preservation, management, or restoration of natural environments and the ecological communities that inhabit them.
- **Policy:** Principles, plans, or procedures (e.g., strategies) in design phase, adopted or implemented by a government body or agency at national/subnational level, to facilitate conservation work (including those related to international treaties).
- **Policy instruments**: Policy instruments are usually defined as the tools of the government for implementing their policy. The following types of policy instruments can be found in the national policy framework: legislative and regulatory instruments (of binding or non-binding nature), economic instruments, monitoring and information instruments and funding.
- **Acts, Laws, Regulations:** This refers to the laws, regulations, agreements, and common law that govern how humans interact with wetlands. This includes environmental regulations; laws governing management of natural resources, and related topics such as environmental impact assessments.

Potential sources to fill in this template:

- National legal acts
- National strategies, action plans
- National guidance documents, other planning documents, consultancy reports
- Academic papers
- Grey literature, web articles
- Expert knowledge (i.e., your own expertise and/or an external expert judgement)

A. Identification of the institutional governance architecture and the legal and policy framework for coastal wetlands conservation

The following section describes the institutional "governance" architecture dealing with coastal wetland management, explaining as much as possible the different levels, as well as the main Acts, Laws, Regulations at national level governing, focusing as much as possible on the interface of conservation and restoration of the coastal wetlands.

COUNTRY NAME

Question 1) Which **public authorities** are responsible for coastal wetland conservation and restoration in your country?

*Please describe the **general distribution** of roles and duties on coastal wetland conservation and restoration across different governance levels (central government vs. regional government) and policy fields (climate mitigation & adaptation; nature & biodiversity; water quality, coastal/marine planning and management).*

*Focus on the **main** actors in the governance of coastal wetlands conservation in your country.*

Specify the responsibilities of the lead authorities, i.e., those responsible for policy, planning, monitoring, enforcement.

*If you have **a flow-chart of governance structure of national-regional levels and/or sectorial** (also in native language), please include it.*

a) **At the national level, which is the lead authority or authorities for policy on coastal wetland restoration and conservation?** If there are several leading authorities, please name all of them and specify the responsibilities

b) **At the national level, which authorities are responsible for planning, monitoring, and enforcement of coastal wetland restoration and conservation?**
- Planning:
- Monitoring:
- Enforcement:

c) **Do institutions at subnational level also play a major role in coastal wetland conservation?** If so, please indicate only the main institutions responsible for conservation (i.e., protection and restoration) programmes on coastal wetlands, and specify their responsibilities (policy, planning, monitoring, enforcement, if these are carried out by different institutions).
- Policy:
- Planning:
- Monitoring:
- Enforcement:

d) **Indicate whether there are main overlapping responsibilities among institutions and across different governance levels on coastal wetland restoration and conservation and whether such an overlap results in conflicts** (e.g. given the location of coastal wetlands, encompassing both land and sea, there may be jurisdiction overlap in the designation of responsibilities in their management).

Question 2a) What **national climate mitigation and adaptation policies and laws** are relevant to coastal wetland conservation (i.e., protection and/or restoration)?

Please describe the policy and legal instruments relevant for coastal wetlands in your country by filling in the template below. Provide information about the most recent version of the instrument.

In the table below, please describe **regulatory and legally binding instruments** for coastal wetland conservation (e.g., laws, regulations, agreements, etc.).

Name and type *(law, agreement, regulation, etc.)* **of the legal instrument**	**1. Briefly describe the objectives of the instrument and specific measures for coastal wetlands.** **2. Describe status of legal instrument (in design phase, adopted or implemented) and timeframe.** **3. Indicate whether monitoring and/or funding provisions for coastal wetlands are included and whether funding is allocated.** **4. Specify any provisions for environmental economic instruments (e.g. payments for ecosystem services).***	**Does this instrument result from or trans-pose an EU or global policy (e.g., Ramsar Convention) or regional sea convention?**
Name: **Type:**		◯ Yes ◯ No Please name it:
Name: **Type:**		◯ Yes ◯ No Please name it:
...		...

In the table below, please describe **regulatory and legally NON-binding instruments** for coastal wetland conservation (e.g., strategies, action plans, etc.).

Name and type *(strategy, action plan etc.)* **of the legal instrument**	**1. Briefly describe the objectives of the instrument and specific measures for coastal wetlands.** **2. Describe status of policy (in design phase, adopted or implemented) and timeframe.** **3. Indicate whether monitoring and/or funding provisions for coastal wetlands are included and whether funding is allocated.** **4. Specify any provisions for environmental economic instruments (e.g. payments for ecosystem services).**	**Does this instrument result from or trans-pose an EU or global policy (e.g., Ramsar Convention) or regional sea convention?**
Name: **Type:**		◯ Yes ◯ No Please name it:
Name: **Type:**		◯ Yes ◯ No Please name it:
...		...

a) **Is a definition of coastal wetlands provided in the described policies and laws?** If yes, please provide the definition indicating the related policy/law in the field below.

◯ Yes, please explain: _____

◯ No

b) **Is a definition of "blue carbon" provided in the described policies and laws?** If yes, please provide the definition indicating the related policy/law in the field below.

◯ Yes, please explain: _____

◯ No

Question 2b) What **national nature and biodiversity policies and laws** are relevant to coastal wetland conservation (protection and/or restoration)?

Please describe the policy and legal instruments relevant for coastal wetlands in your country by filling in the template below. Provide information about the most recent version of the instrument.

In the table below, please describe **regulatory and legally binding instruments** for coastal wetland conservation (e.g., laws, regulations, agreements, etc.).

Name and type *(law, agreement, regulation, etc.)* **of the legal instrument**	**1. Briefly describe the objectives of the instrument and specific measures for coastal wetlands. 2. Describe status of legal instrument (in design phase, adopted or implemented) and timeframe. 3. Indicate whether monitoring and/or funding provisions for coastal wetlands are included and whether funding is allocated. 4. Specify any provisions for environmental economic instruments (e.g. payments for ecosystem services).***	**Does this instrument result from or trans-pose an EU or global policy (e.g., Ramsar Convention) or regional sea convention?**
Name: **Type:**		◯ Yes ◯ No Please name it:
Name: **Type:**		◯ Yes ◯ No Please name it:
...		...

In the table below, please describe **regulatory and legally NON-binding instruments** for coastal wetland conservation (e.g., strategies, action plans, etc.).

Name and type *(strategy, action plan etc.)* **of the legal instrument**	**1. Briefly describe the objectives of the instrument and specific measures for coastal wetlands. 2. Describe status of policy (in design phase, adopted or implemented) and timeframe. 3. Indicate whether monitoring and/or funding provisions for coastal wetlands are included and whether funding is allocated. 4. Specify any provisions for environmental economic instruments (e.g. payments for ecosystem services).**	**Does this instrument result from or trans-pose an EU or global policy (e.g., Ramsar Convention) or regional sea convention?**
Name: **Type:**		◯ Yes ◯ No Please name it:
Name: **Type:**		◯ Yes ◯ No Please name it:
...		...

a) **Is a definition of coastal wetlands provided in the described policies and laws?** If yes, please provide the definition indicating the related policy/law in the field below.

◯ Yes, please explain: _____

◯ No

b) **Is a definition of "blue carbon" provided in the described policies and laws?** If yes, please provide the definition indicating the related policy/law in the field below.

◯ Yes, please explain: _____

◯ No

Question 2c) What **national water, coastal and marine policies and laws** are relevant to coastal wetland conservation (protection and/or restoration), e.g. related to water quality, coastal/marine planning and management?

Please describe the policy and legal instruments relevant for coastal wetlands in your country by filling in the template below. Provide information about the most recent version of the instrument.

In the table below, please describe **regulatory and legally binding instruments** for coastal wetland conservation (e.g., laws, regulations, agreements, etc.).

Name and type *(law, agreement, regulation, etc.)* **of the legal instrument**	**1. Briefly describe the objectives of the instrument and specific measures for coastal wetlands.** **2. Describe status of legal instrument (in design phase, adopted or implemented) and timeframe.** **3. Indicate whether monitoring and/or funding provisions for coastal wetlands are included and whether funding is allocated.** **4. Specify any provisions for environmental economic instruments (e.g. payments for ecosystem services).***	**Does this instrument result from or trans-pose an EU or global policy (e.g., Ramsar Convention) or regional sea convention?**
Name: **Type:**		◯ Yes ◯ No Please name it:
Name: **Type:**		◯ Yes ◯ No Please name it:
...		...

In the table below, please describe **regulatory and legally NON-binding instruments** for coastal wetland conservation (e.g., strategies, action plans, etc.).

Name and type *(strategy, action plan etc.)* **of the legal instrument**	**1. Briefly describe the objectives of the instrument and specific measures for coastal wetlands.** **2. Describe status of policy (in design phase, adopted or implemented) and timeframe.** **3. Indicate whether monitoring and/or funding provisions for coastal wetlands are included and whether funding is allocated.** **4. Specify any provisions for environmental economic instruments (e.g. payments for ecosystem services).**	**Does this instrument result from or trans-pose an EU or global policy (e.g., Ramsar Convention) or regional sea convention?**
Name: **Type:**		◯ Yes ◯ No Please name it:
Name: **Type:**		◯ Yes ◯ No Please name it:
...		...

a) Is a definition of coastal wetlands provided in the described policies and laws? If yes, please provide the definition indicating the related policy/law in the field below.

◯ Yes, please explain: _____

◯ No

b) Is a definition of "blue carbon" provided in the described policies and laws? If yes, please provide the definition indicating the related policy/law in the field below.

◯ Yes, please explain: _____

◯ No

Question 2d) What **sub-national policies and laws** address coastal wetland conservation (protection and/or restoration)?

Please provide a general overview of the existing or planned sub-national policies and laws. Provide the information about the most recent version of the documents.

Please note that we are not aiming for a systematic and exhaustive inventory of all relevant policies and laws at sub-national level. This section can be filled based on your expert knowledge and using prominent policy examples from a selection of regions in the country.

Example of a sub-national policy or regulation: a voluntary carbon market regulation.

Are subnational policies (e.g., strategies, action plans, etc.) or regulations (laws, standards, etc.) relevant to coastal wetlands conservation in your country? If yes, please fill in the following tables, focusing on sub-national policies that go in their scope and objectives beyond the national policies (i.e., containing more detailed, focused, advanced provisions).

◯ Yes ◯ No

In the table below, please describe **regulatory and legally binding instruments** for coastal wetland conservation (e.g., laws, regulations, agreements, etc.).

Name and type *(law, agreement, regulation, etc.)* **of the legal instrument**	**Policy field to which the sub-national legal instrument belongs** *(multiple answers are possible)*	**1. Briefly describe the objectives of the instrument and specific measures for coastal wetlands.** **2. Describe status of policy (in design phase, adopted or implemented) and timeframe.** **3. Indicate whether monitoring and/or funding provisions for coastal wetlands are included and whether funding is allocated.** **4. Specify any provisions for environmental economic instruments (e.g. payments for ecosystem services).***
Name: **Type:**	◯ Climate Mitigation and Adaptation ◯ Nature and Biodiversity ◯ Water Quality, Coastal/ Marine Planning and Management ◯ Other:	
Name: **Type:**	◯ Climate Mitigation and Adaptation ◯ Nature and Biodiversity ◯ Water Quality, Coastal/ Marine Planning and Management ◯ Other:	
...	...	

In the table below, please describe **regulatory and legally NON-binding instruments** for coastal wetland conservation (e.g., strategies, action plans, etc.).

Name and type *(strategy, action plan, etc.)* **of the legal instrument**	**Policy field to which the sub-national legal instrument belongs** *(multiple answers are possible)*	**1. Briefly describe the objectives of the instrument and specific measures for coastal wetlands.** **2. Describe status of policy (in design phase, adopted or implemented) and timeframe.** **3. Indicate whether monitoring and/or funding provisions for coastal wetlands are included and whether funding is allocated.** **4. Specify any provisions for environmental economic instruments (e.g. payments for ecosystem services).***
Name: **Type:**	◯ Climate Mitigation and Adaptation ◯ Nature and Biodiversity ◯ Water Quality, Coastal/ Marine Planning and Management ◯ Other:	
Name: **Type:**	◯ Climate Mitigation and Adaptation ◯ Nature and Biodiversity ◯ Water Quality, Coastal/ Marine Planning and Management ◯ Other:	
...	...	

a) Is a definition of coastal wetlands provided in the described policies and laws? If yes, please provide the definition indicating the related policy/law in the field below.

◯ Yes, please explain: _____

◯ No

b) Is a definition of "blue carbon" provided in the described policies and laws? If yes, please provide the definition indicating the related policy/law in the field below.

◯ Yes, please explain: _____

◯ No

* By definition, payments for ecosystem services (PES) typically involve voluntary transactions between the beneficiaries and providers of ecosystem services. See example of a PES scheme to incentive farmers to adopt improved agricultural and land-use practices in a water catchment area here: https://www.ecologic.eu/sites/default/files/publication/2023/PONDERFUL-SustainableFinancingInstruments-PES_0.pdf.

B. Protection of coastal wetlands

This section aims to provide understanding of the policies related to the protection of coastal wetlands (e.g., through establishing protected and strictly protected areas, designating coastal wetlands as heritage sites or sites of international importance, establishing particular property regime, etc.).

Question 3) What area of coastal wetlands is currently **protected** by national laws?

The area is classified as a protected area in line with the IUCN Protected Area Categories System. To avoid overlapping designations, please omit information on Natura 2000 sites or areas covered by international conventions to which the country is a signatory (e.g., Convention on Biological Diversity).

Please provide the information in % out of total coastal wetland area in the country, if it is available. The answer can be based on your expert judgement only; in this case, please indicate the level of certainty in the answer provided.

◯ < 10% ◯ 10-30% ◯ 30-50% ◯ 50%<

Please describe and indicate the level of certainty in the chosen option:

◯ high ◯ moderate ◯ low ◯ very low

Explanation/data source: _____

a) **What is the level of protection for nationally designated coastal wetland areas?** Please provide a description of the type of designation of protected areas in your country (fully or partially protected).

b) **Are there plans at national level to increase coastal wetland protection in order to contribute to newly adopted obligations at EU level (e.g., the EU Biodiversity Strategy 2030 targets of 30% of protected EU land area and 30% of protected EU sea area and 10% of strictly protected; targets under the EU Nature Restoration Law)?**

◯ Yes ◯ No

Please describe: _____

Question 4) What is the **property/users regime** for the access and use of natural resources in the coastal wetlands?

a) **Most of the protected coastal wetlands are .... property:**

◯ public/state ◯ private ◯ common

Please describe: _____

b) **Are there public-private partnerships or agreements present at national level for coastal wetland resource management (agreements with private actors and CSOs)?**

◯ yes ◯ no

Please describe: _____

C. Restoration of coastal wetlands

This section aims to define and describe the policy and regulatory instruments relevant to the restoration of coastal wetlands at national level and the benefits such restoration can entail.

Question 5) Does a **national restoration plan or similar strategy** already exist in the country?

If there is a draft version of the national restoration plan available, please consider it, and describe it as well.

◯ Yes ◯ No

Please describe: _____

a) What is the share of coastal wetland area that shall be restored under the national restoration plan compared to the total national wetland area (in %)?

Please describe: _____

Question 6) Does the **national restoration plan or similar strategy in your country address ecosystem services** of coastal wetlands?

Please indicate if there are qualitative and quantitative targets anchored in the policy.

a) Does the national restoration plan (or similar strategy) include provisions for disaster risk reduction and climate adaptation through coastal wetland restoration? (e.g., limiting the negative effects of droughts through supporting natural water retention; reducing flood risks through sediment stabilization and retention; risk assessments of such events)

◯ yes ◯ no

Please explain and provide qualitative and quantitative targets, if available: _____

b) Does the national restoration plan (or similar strategy) aim to lead to an increase in carbon soil stocks in wetlands (blue carbon) or decrease greenhouse gas emissions from coastal wetlands?

◯ yes ◯ no

Please explain and provide qualitative and quantitative targets, if available: _____

c) Does the national restoration plan (or similar strategy) contain provisions for improving water quality through wetlands restoration?

◯ yes ◯ no

Please explain and provide qualitative and quantitative targets, if available: _____

d) Does the national restoration plan (or similar strategy) include provisions for improving coastal biodiversity and habitats in the wetlands? (e.g., presence of rare, endangered or threatened species; wetland complexity, vegetation cover/density, increase connectivity at the land-sea interface)

◯ yes ◯ no

Please explain and provide qualitative and quantitative targets, if available: _____

D. Good practice examples of policies and laws for coastal wetlands restoration

The following section concerns policies and laws that you consider as good practices (front runners) in your country for coastal wetland restoration. The good practices can be considered for more detailed case study development on specific national policies particularly supportive of coastal wetland restoration.

Question 7) Out of the policies described in Questions 2a–2d, which one has the greatest potential to benefit and support coastal wetland restoration in your country?

Please name and describe the policy and/or legal instruments.

Ideally, there should be literature/sources available describing the good practice policy and the policy should help address one or more of the implementation barriers mentioned in Annex I (barriers most relevant to your country).

a) **Please describe the potential good practice specifying its strengths and limitations?** (e.g., policy provides clear definition and coverage of coastal wetland ecosystems; it clearly defines restoration targets for coastal wetlands; its restoration requirements are mandatory for coastal wetlands; it makes provisions for management/conservations plans for coastal wetlands, etc.):

_____

b) **What kind of implementation barriers that so far hinder coastal wetland restoration in your country does the good practice policy tackle?**

_____

E. Policy monitoring for coastal wetland restoration

This section deals with the mechanisms for reporting, tracking, and adaptively managing national programmes that involve restoration of coastal wetlands.

Question 8) Is there a mechanism in place for **monitoring the effectiveness of national instruments** that deal with restoring coastal wetlands?

The following questions deal with the mechanisms for tracking and evaluating policies (non-regulatory such as strategies, etc.) on coastal wetlands.

a) **Are there specific methods and tools in place to track and evaluate performance of policies?** (e.g., overall status from Ramsar Site Management Effectiveness Tracking Tool, stakeholder surveys, Evaluation Commissions, etc.)

◯ yes ◯ no

Please describe: _____

b) **Is there a classification of coastal wetlands based on their health condition or restoration potential at the national or subnational level (regions)?**

◯ yes ◯ no

Please describe: _____

Question 9) What are the **mechanisms and tools to support evidence-informed decision making for coastal wetlands** used at national level?

The following questions deal with the mechanisms for reporting and tracking progress in coastal wetlands.

a) Are there specific indicators in place used for tracking the progress in coastal wetlands at national level?

- ◯ Vegetation Index (cover/density)
- ◯ Water in Wetland Index (hydroperiod)
- ◯ Natural Coastal Wetland Extent (area)
- ◯ Change in Coastal Wetland Area (surface change)
- ◯ Status and trend of water quality
- ◯ Wetland ecosystem fragmentation (density of wetlands in the coastal landscape)
- ◯ Coastal Wetland Artificialization (area)
- ◯ Population trend of rare, endangered or threatened species
- ◯ Other:

Please describe: _____

b) What are reporting metrics for wetlands used at national level?

Please describe: _____

c) What spatial data layers are used at the national level?

Please describe: _____

Annex 3: Example of national policy inventory: France

Table 10: Policy inventory France: Main legal and policy instruments for coastal wetland conservation and restoration.

Name of policy	Objectives of the policy and specific measures for coastal wetlands
NATURE AND BIODIVERSITY POLICIES AT NATIONAL LEVEL	
Law on Water and Aquatic Environments (2006)	• Focuses on actions to preserve, restore, maintain, and improve the management of aquatic environments and wetlands. It is aligned with the WFD. • Promotes the balanced and sustainable water management considering the necessary adaptation to climate change. • Aims to ensure the prevention of flooding and the preservation of **aquatic ecosystems, sites, and wetlands**; wetlands are defined as land, whether exploited or not, that is usually permanently or temporarily flooded or inundated with fresh, salt or brackish water, or where the vegetation, when it exists, is dominated by hygrophilous plants for at least part of the year.
Law for the Reconquest of Biodiversity, Nature, and Landscapes (2016)	• The Law anchors several provisions explicitly referring to wetlands: - Art. 61.2 directly addresses **wetland management and biodiversity restoration in aquatic ecosystems and wetlands**. - Art. 66 establishes that wetlands may be proposed for designation as Ramsar sites if their preservation is of international interest from the ecological, botanical, zoological, limnological or hydrological point of view.
The 4th National Wetlands Plan 2022–2026 under the National Biodiversity Strategy 2030	Specific objectives for wetland restoration: • **double the surface area of wetlands under high protection in mainland France by 2030** and strengthen the inclusion of these environments in all protected areas in mainland France, i.e. an increase of around 110,000 ha. A similar ambition will be pursued in all protected areas of various statuses; • **acquire 8,500 ha of wetlands** and create new protected areas, including a 12th national park dedicated to wetlands specifically; • **restore 50,000 ha of wetlands** by 2026; • improve the functioning of wetlands by **restoring watercourses**. With its third edition published in 2023, the **National Biodiversity Strategy 2021–2030** commits to continue efforts to restore wetlands as set out in the 4th National Wetlands Plan 2022–2026, targeting 50,000 ha of restored wetlands by 2026. It elaborates on the following objectives in relation to wetlands: Action 1: Continue and set up wetland restoration initiatives with a target of 50,000 ha by 2026. Action 2: Define a framework for identifying restoration priorities that should be ready in 2024. Action 3: Strengthen resources and help operators to benefit from them. Action 4: Strengthen the restoration capabilities of operators by developing the necessary ecological engineering (in terms of skills, know-how and equipment).
Green and Blue Grid (TVB) (2007)	It aims to conserve and restore a network of ecological connections, facilitating the circulation, feeding, reproduction, and resting of animal and plant species, thereby ensuring their life cycle. Since 2007, this approach has integrated biodiversity preservation into land-use planning decisions, without explicitly mentioning coastal wetlands, however.
National Strategy for Protected Areas 2030 (2021)	• Aims to protect at least 30% of the territory, including one third under strong protection (i.e. 10% of the territory) and to intensify the protection of ecosystems of remarkable interest and particularly threatened. For this purpose, the Strategy aims to develop areas under strong protection, as a priority targeting remarkable biodiversity-rich ecosystems or those particularly vulnerable to future changes, such as wetlands. • It sets an objective to double the surface area of wetlands under high protection in metropolitan France without excluding the possibility of designating a wetlands national park.

CLIMATE POLICIES AT NATIONAL LEVEL	
Act to Combat Climate Change and Strengthen Resilience to its Effects ("Climate and Resilience Law") (2021)	• Aims to accelerate the ecological transition and sustainable development of French society and the economy to tackle climate change. • Chapter III on protecting ecosystems and biodiversity: Calls for "respect for natural balances" which "involves **preserving and, where necessary, restoring the natural functions of aquatic ecosystems**, whether surface or underground, including wetlands, and marine ecosystems, as well as their interactions" (art. 45). The provision recognises ecosystem services of these ecosystems, including biodiversity support, climate mitigation and adaptation, and pollution control. It is declared that "aquatic and marine ecosystems are essential elements of the nation´s heritage". • Prescribes for any ICZM strategy to consider **the contribution of coastal ecosystems** to coastal zones management.
3rd National Climate Change Adaptation Plan (2025)	• Adopted as an implementation instrument under the National Strategy for Adapting to Climate Change (2006). It consists of 52 measures, each setting forth a number of actions. The most relevant measures and actions are presented further below. • **Measure 3: Protecting the population from floods by adapting risk prevention policy.** Action 7: Facilitate and promote the maintenance of river and canals, and the management of aquatic environments through nature-based solutions linked to flood prevention. The deployment of these solutions at watershed level will help maintain flood expansion zones and wetlands, and the creation and maintenance of hedgerows, in line with the Hedgerow Pact, will help to slow down and reduce the impact of flooding • **Measure 4: Protecting the population from the consequences of coastal retreat by rethinking the development of exposed areas** Action 1: Restore or maintain coastal forest habitats, dune ecosystems, seagrass beds, coastal grasslands, mangroves, coastal marshes and coral reefs and further develop flexible coastal management through nature-based solutions (NbBS) to limit coastline retreat and flooding and protect the coastal area (2025) • **Measure 20: Deploy nature-based solutions for adaptation** • **Measure 37: Supporting farms and the agri-food industry in the face of climatic hazards and initiating the transition to resilient, low-carbon models** Action 6: Payments for Environmental Services (PES): identify indicators and deploy PES to maintain and develop grasslands, wetlands and agro-ecological infrastructure (2025–2027) Action 7: Develop nature-based solutions in the aquaculture section (from 2024) Action 28: Measure 30 of the Water Plan: Development of Nature-Based Solutions • **Measure 43: Promotion the adaptation and resilience of natural environment and species to climate change** Action 4: acceleration the restoration of river morphology, associated landscapes and wetland functions in line with the WFD and the aquatic aspects of the EU NRR (from 2024) Action 10: Acceleration the coverage of French inventories (2025–2027) Action 11: Monitor the evolution of wetlands under climate change through the development and use of a modelling tool (from 2024)
Label Bas-Carbone (Low Carbon Label) (2019)	• Governmental crediting scheme designed to incentivise projects that reduce emissions and sequester carbon, primarily in terrestrial ecosystems. The Low Carbon Label is designed to bridge the gap between project initiators and financiers, fostering local initiatives aimed at reducing GHG emissions. Its primary objectives are to promote transparency and effectiveness in financing projects that contribute to France's 2050 GHG emission reduction targets. • In 2023, the scope was extended to include a method for valuing the carbon stock sequestered in **Posidonia meadows**, a type of coastal wetlands undergoing degradation due to anchoring along France's Mediterranean coast. The scheme focuses solely on quantifying carbon sequestration resulting from the prevention of seagrass habitat degradation. This targeted approach, addressing a specific type of blue carbon ecosystem and threat, aims to streamline initiative development costs. Certified projects must undergo recertification every five years and can operate for up to 30 years.

WATER, MARINE AND COASTAL POLICIES AT NATIONAL LEVEL	
Law on Water (1992)	• The Law intends to ensure balanced and sustainable management of water resources. This management takes into account the necessary adaptation to climate change and, among other things, aims to ensure the prevention of flooding and the preservation of aquatic ecosystems, sites and wetlands; **wetlands are defined** as land, whether exploited or not, that is usually permanently or temporarily flooded or inundated with fresh, salt or brackish water, or where the vegetation, when it exists, is dominated by hygrophilous plants for at least part of the year. • The Law on Water does not specifically target coastal wetlands, but it is the **first legislation providing different basins with a planning instrument**, i.e., the River Basin Water Development and Management Framework Plans and with Water Development and Management Schemes at local level.
Law on the Development, Protection and Enhancement of the Coastal Zone (1986)	• It covers more than 1,200 municipalities bordering the sea, as well as large lakes, estuaries, and deltas. • A decree sets the list of areas and environments to be preserved, including in particular, depending on their ecological interest, **coastal dunes and moors, beaches and lidos, coastal forests and wooded areas, uninhabited islets and the natural parts of estuaries, rias or abers and capes, marshes, mudflats, wetlands and areas temporarily under water**, as well as **resting, nesting and feeding areas for the avifauna** designated by the Birds Directive.
Law on the Modernisation of Territorial Public Action (2014)	• It gives local authorities a legal tool entitling them with exclusive and compulsory powers in management of aquatic environments and flood prevention (GEMAPI). Among its missions, it explicitly includes the **protection and restoration of sites, aquatic ecosystems, and wetlands**, as well as and riparian woodland, and introduces a GEMAPI tax. However, no explicit mention of coastal wetlands is established.
National Strategy for Integrated Coastline Management (2012)	• It aims to strengthen the resilience of coastal areas by drawing on the role of natural coastal environments. These ecosystems are valuable assets in mitigating the effects of natural phenomena, such as marine submersion, erosion, flooding, etc. • Its key objective is to **protect and restore coastal ecosystems**, e.g. wetlands, dune belts, mangroves, coral reefs, which dissipate the sea´s energy and help limit the impact of coastal erosion on activities and property.
National Sea and Coastal Strategy (2017)	• It is an overarching framework, guiding environmental protection, marine resource development, and integrated management of sea and coastal activities, excluding those solely for defence or national security. It defines maritime façades and aims to coordinate all sectoral policies relating to the sea and **coastal areas**, especially the protection of the environment as well as biological and ecological balances. • The National Strategy is implemented through sea basin strategy documents in mainland France, addressing MSFD and MSPD requirements. These strategic documents outline objectives for integrated management of sea and coastal zones, ensuring compliance with the National Strategy principles. All plans, programmes, schemes, and authorisations at sea must align with these objectives, while those on land must consider them. • The goal is to safeguard highly sensitive areas from urbanization, where the principle of environmental protection must be prioritised over the development principle. Coastal, littoral, and estuarine zones, facing the strongest pressures due to human activity and hosting unique habitats, are particularly sensitive to the effects of long-term trends and extreme weather events. So, acquiring new data, as well as digitising and interpreting old data, on the dynamics of the coastline and coastal erosion are priority issues for coastal territories. Priority should be given to the impact of rising sea levels, changing storm patterns, and offshore energy dissipation on coastal areas.

SUBNATIONAL POLICIES	
River Basin Water Development and Management Framework Plans (SDAGE) & River Basin Water Management Schemes (SAGE)	• These documents possess full regulatory authority: the regulations and cartographic documents they contain are explicitly declared by law as enforceable against third parties for the execution of any installation, work, or activity subject to declaration or water police authorization. • The SDAGE is complemented by a Programme of Measures, serving as the actionable component of the SDAGE by outlining key actions to achieve set objectives. These plans are developed in consultation with basin committees, bringing together elected representatives, water users and administrative representatives. • The SAGE includes a plan for the sustainable development and management of water resources and related ecosystems (PAGD) outlining conditions for achieving set objectives and regulations. The PAGD may identify several types of wetlands, which are then delimited by prefectorial decree. These include **wetlands of particular environmental interest**, for which action programmes are implemented, Strategic Water Management Zones, where easements can be established.

Restoring Coastal Wetlands in Europe

Pilot roadmap on coastal wetland restoration in Portugal

DECEMBER 2025

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Addressing climate change, biodiversity loss and habitat degradation towards a sustainable management of European wetlands.

Ria de Aveiro, Portugal
Source: © RESTORE4Cs, University of Salento / LIFEWatch ERIC

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Executive Summary

Planning the restoration of coastal wetland habitats is a key element for National Restoration Plans under the EU Nature Restoration Regulation, national commitments under the Ramsar Convention as well as reporting requirements on wetlands emissions and removals under the EU Regulation on Land Use, Land Use Change and Forestry.

This pilot roadmap is designed to support national authorities and stakeholders in Portugal in developing a strategic framework for planning coastal wetland restoration, for example in the context of National Restoration Plans. It draws on the latest scientific data, tools and methods developed by the EU-funded project RESTORE4Cs. The roadmap follows the step-wise approach set out in the RESTORE4Cs Implementation Roadmap to Guide National Action for coastal wetland restoration, thereby contributing to the achievement of key policy targets for climate and biodiversity.

About the project

RESTORE4Cs (Modelling **RESTOR**ation of w**E**tlands for **C**arbon pathways, **C**limate **C**hange mitigation and adaptation, ecosystem services, and biodiversity, **C**o-benefits) is a Horizon Europe project led by the University of Aveiro, which evaluated the effect of restoration actions on wetlands´ ability to mitigate climate change and provide various ecosystem services. Its mission is to support the implementation of EU climate and biodiversity policies, by:

- gathering effectiveness data on restoration and land use management actions;
- structuring a European Community of Practice;
- upscaling models and integrative assessment tools;
- designing a multi-actor approach for stakeholder engagement.

RESTORE4Cs identified six Case Pilots for its activities. These comprise coastal wetland ecosystems in different states of preservation, with various alterations, and offering a range of restoration measure types already in place.

The six Case Pilot sites provide a good geographical representation within Europe and its biogeographical regions: Mediterranean (Valencian Wetlands in Spain and Camargue in France), Atlantic (Ria de Aveiro in Portugal and South-West Dutch Delta in the Netherlands), Baltic (Curonian Lagoon in Lithuania) and the Black Sea (Danube Delta in Romania).

Project´s results are available through a digital platform serving as a Decision Support System (DSS) for stakeholders and wetland practitioners and providing more reliable information to drive and prioritise wetlands restoration actions.

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List of Abbreviations

ANC	National Climate Authority
APA	Portuguese Environmental Agency
CAP	Common Agricultural Policy
CH_4	Methane
CLC	CORINE Land Cover
CO_2	Carbon Dioxide
CORINE	Coordination of Information on the Environment
CRF	Common Reporting Format
DGT	Directorate-general for the Territory
EC	European Commission
ECoP	European Community of Practice
ENCNB	National Strategy for Nature Conservation and Biodiversity 2030
EU	European Union
GHG	Greenhouse Gas
GIS	Geographic Information System
ICNF	Institute for Nature Conservation and Forests
LULC	Land-Use/Land-Cover
LULUCF	Land Use, Land-Use Change and Forestry
MCA	Multi-Criteria Analysis
MSFD	Marine Strategy Framework Directive
N_2O	Nitrous Oxide
NbS	Nature-based Solutions
NECP	National Energy and Climate Plans
NGO	Non-Governmental Organisation
NRP	National Restoration Plan
NRR	Nature Restoration Regulation
NUTS	Nomenclature of Territorial Units for Statistics
PES	Payment for Ecosystem Services
PGBH	River Basin Management Plans (Planos de Gestão de Bacias Hidrográficas)

POCs	Portugal´s Zones Programmes
PRW	Potentially Restorable Wetlands
PWA	Potential Wetland Areas
RBMP	River Basin Management Plan
UAA	Utilised Agricultural Area
UNEA	United Nations Environment Assembly
WFD	Water Framework Directive
WP	Work Package

Glossary

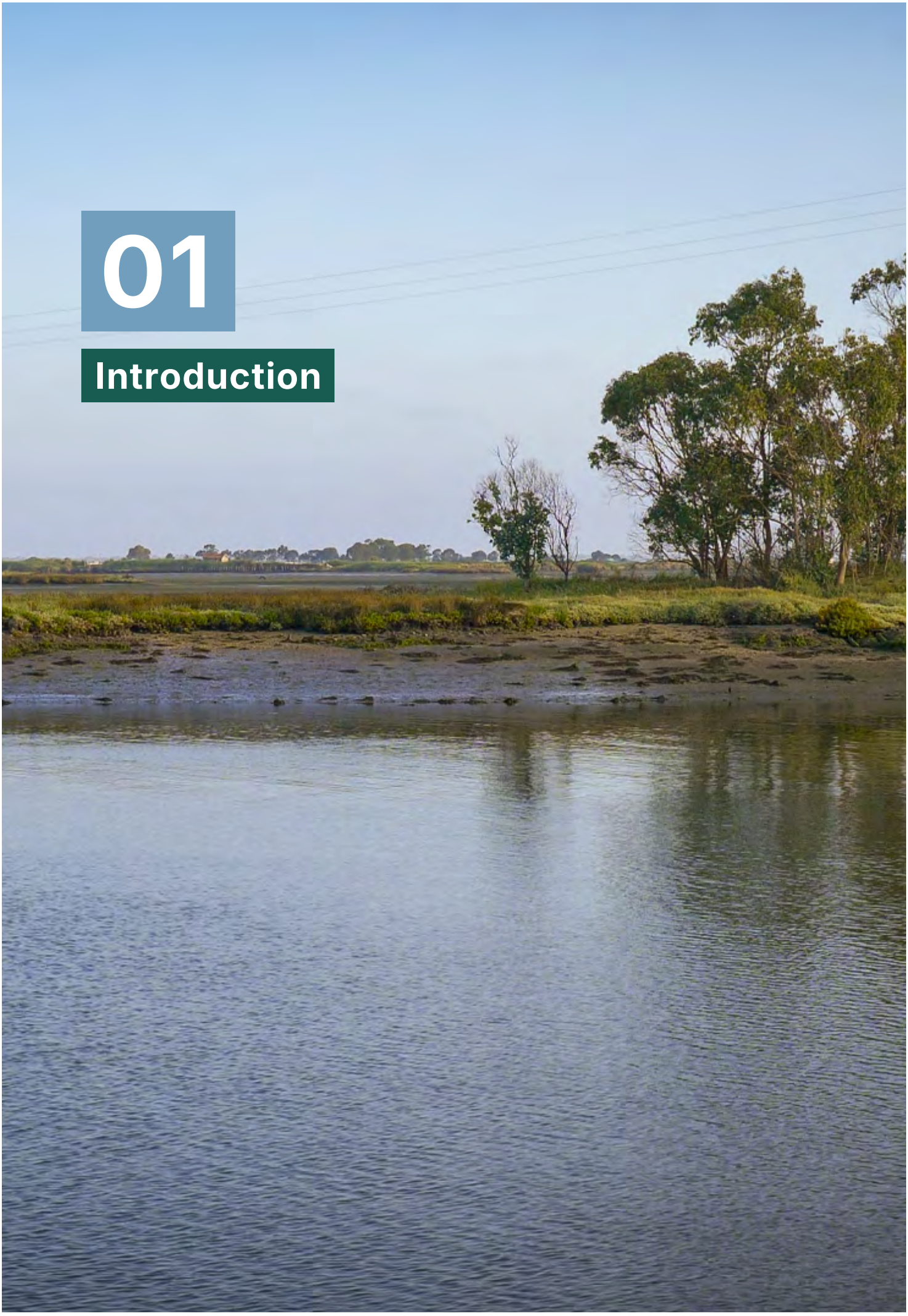
Active restoration	Process that eliminates the source of degradation and disturbance of an ecosystem and implements measures to accelerate its recovery and overcome obstacles to that recovery.
Coastal wetlands	Coastal wetlands are areas along coastlines that are temporarily or permanently flooded by salt, brackish or fresh water. These ecosystems are characterised by phreatophylic and submerged vegetation. According to the Ramsar Convention, coastal wetlands include "water that is static or flowing, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six meters"[1]. European coastal wetlands include seagrass, tidal and freshwater marshes as well as tidal and non-tidal flats and creeks. These habitats can be found in coastal lagoons, estuaries, and other transitional waters, as well as in fjords, sea lochs, and embayments[2]. This harmonised definition of coastal wetlands was developed based on the work conducted in the RESTORE4Cs Horizon Europe project. It is aligned with the Ramsar Convention and captures the full land-sea-continuum.
Index	An index is a composite measure that combines multiple variables to provide a comprehensive overview of a specific issue or performance area. Indexes are often used to simplify complex data sets and present a broad picture of trends and changes over time. An example of an index could be the Coastal Wetland Health Condition Index, which might include indicators related to water quality, biodiversity, and habitat extent.
Metric	A metric is a quantifiable measure used to track and assess the status of a specific process or activity. Metrics are usually more granular and detailed than indicators and can be used to support the calculation of indicators and indexes. For example, a metric for coastal wetland health might be the number of bird species observed in a wetland area or the concentration of pollutants in wetland water.
Nature-based solution	Nature-based solutions are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits[3].
Passive restoration	Process that eliminates the factors of degradation and disturbance and permits the natural regeneration of the ecosystem.

1 Ramsar Convention. (1971). *Convention on Wetlands of International Importance especially as Waterfowl Habitat*. Ramsar Secretariat. Ramsar, Iran. Available at: https://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf.

2 Otero, M. et al. (2024). *How can coastal wetlands help achieve EU climate goals?* Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

3 United Nations Environment Assembly (UNEA). (2022). *Nature-based solutions for supporting sustainable development.* United Nations Environment Resolution UNEP/EA.5/Res.5. Available at: https://wedocs.unep.org/rest/api/core/bitstreams/4caa2911-37ea-4915-b378-d2c2d525ee35/content.

Policy indicator	A policy indicator is a specific, measurable element used to assess and track progress towards achieving policy goals and objectives, focusing on inputs, output and outcome measures. These indicators are designed to provide timely, relevant information that informs decision-makers about the effectiveness of policies. They are based on criteria that aim to capture the relevance for the targeted (policy) questions by providing timely, relevant information on the coastal wetlands and data characteristics, which require spatially explicit and quantity-specific data and metrics, e.g. descriptive statistics, coverage, type, scale and/or year. For example, a policy indicator for coastal wetland restoration might be the percentage increase in restored wetland areas.
Stakeholder	Any group or individual who can affect or is affected by wetland management.
Wetland management	Refers to the policies, practices and actions taken to maintain or restore the natural state and functions of wetland ecosystems. This involves a balance between the conservation of wetlands for their ecological benefits and the sustainable use of these areas for human needs. The goal is to ensure that wetlands continue to provide their essential services to humans and nature. Effective wetlands management strategies may include protecting wetlands from anthropogenic threats, regulating water levels to mimic natural cycles and prevent degradation, restoring wetland habitats that have been lost, damaged or degraded, implementing policies that encourage sustainable use and conservation efforts.
Wetland restoration	A key aspect of wetlands management is the restoration of lost or altered wetlands. This process often involves re-establishing the natural water flow, removing pollutants, replanting native vegetation or re-creating lost wetland habitats. Restoration projects have been shown to not only bring back lost wetland functions but also to enhance resilience against climate change impacts. Successful wetland restoration efforts can also lead to significant environmental and social benefits.



01

Introduction

1. Introduction

Aim of implementation roadmap on coastal wetland restoration

A national roadmap for coastal wetlands restoration in Portugal is essential to transform high-level policy obligations under the EU Nature Restoration Regulation and national biodiversity strategies into clear, actionable steps with defined targets, timelines, and operational guidelines. It ensures restoration efforts maximize climate and biodiversity benefits by strategically enhancing carbon sequestration and habitats while integrating wetlands into climate adaptation plans.
This roadmap addresses governance and knowledge gaps by creating a centralized framework, improving coordination among agencies, and standardizing data and best practices, as summarised in Table 1. It prioritizes interventions based on ecological value, socio-economic benefits, and resilience, supported by cost-benefit and risk assessments to avoid maladaptation. By embedding restoration objectives into national planning instruments such as Coastal Zone Management Plans and Strategic Environmental Assessments, it aligns land-use decisions, enforces compliance, and establishes monitoring indicators. Ultimately, the roadmap helps Portugal meet regulatory requirements while promoting good practices, improving access to funding opportunities, and contributing positively to EU efforts on nature-based solutions and climate resilience.

Table 1: Summary of the added value of a Roadmap for Coastal Wetlands Restoration in Portugal.

Key Aspect	Why It Matters	What the Roadmap Provides	Risks if no Roadmap
Converts Policy Obligations into Actionable Steps	Portugal's commitments under the EU Nature Restoration Regulation and national biodiversity strategies are high-level and risk fragmentation without clear guidance.	Clear restoration targets (e.g., hectares by 2030); Defined timelines aligned with EU cycles; Operational guidelines for regional authorities.	Fragmented or delayed implementation; Lack of clarity on responsibilities; Non-compliance with EU obligations.
Maximizes Climate and Biodiversity Benefits	Coastal wetlands are vital for carbon sequestration and biodiversity, supporting climate neutrality and Habitats Directive goals.	Strategic location of restoration efforts; Integration into national climate adaptation plans; Reinforced resilience against sea-level rise and extreme weather events.	Missed climate targets; Continued habitat degradation; Increased vulnerability to extreme weather events (e.g., floods, droughts, heat waves).
Addresses Governance and Knowledge Gaps	Current management is fragmented across ICNF, APA, municipalities, and sectors, with limited technical capacity and inconsistent data.	Centralized governance framework; Clear roles and coordination mechanisms; Knowledge-sharing platforms and harmonized monitoring standards.	Duplication of efforts; Inefficient resource use; Decisions based on incomplete or inconsistent data.
Prioritizes Interventions for Cost-Effectiveness and Resilience	Resources are limited; ad hoc actions risk inefficiency and maladaptation.	Prioritization criteria (ecological value, vulnerability, socio-economic benefits); Cost-benefit and climate risk assessments; Avoidance of maladaptive infrastructure.	Wasted resources; Low-impact interventions; Increased risk of maladaptation.

Integrates Restoration into National Planning and Assessment Frameworks	Restoration objectives must align with Coastal Zone Management Plans and Strategic Environmental Assessments.	Alignment with land-use planning; Embedding targets in environmental impact assessments; Monitoring indicators for ecological and climate performance.	Conflicts with land-use priorities; Lack of accountability; Poor monitoring of restoration outcomes.
Positions Portugal to Lead in EU Nature-Based Solutions	Compliance with EU regulations and proactive planning enhances Portugal's standing and funding opportunities.	Demonstrates leadership in nature-based solutions; Improves access to EU funding streams (LIFE, Horizon Europe); Promotes best practices and international visibility.	Missed funding opportunities; Reduced influence in EU policy; Limited recognition of national efforts.

In this context, the goal and scope of this roadmap is to:

- Provide **insights and guidance for national authorities & practitioners in Portugal on how to use the tools and results of the RESTORE4Cs Horizon Europe project** to improve the planning of coastal wetland restoration.
- Support national authorities in **defining priorities for coastal wetland restoration** to contribute to the achievement of key policy targets for climate and biodiversity.

Europe's coastal wetlands are critical ecosystems which can play a crucial role in climate change mitigation and adaptation[4]. When restored, they act as nature-based solutions: reducing greenhouse gas emissions (GHG), removing CO_2 from the atmosphere[5], and acting as natural sponges in the landscape that buffer the impacts of both floods and droughts.

Since 2023, the EU-funded RESTORE4Cs project has been working on the evaluation of the effects of restoration actions on coastal wetlands' ability to mitigate climate change and on the development of methods and tools to support decision-making on coastal wetland restoration. The Ria de Aveiro, a shallow coastal lagoon located in the center of Portugal, was selected as one of the case pilots of RESTORE4Cs to gather data and information on C-storage and GHG emissions[6]. This data and information together with data from other case pilots have contributed to improving the knowledge on wetlands' status, their restoration potential and their capacity as carbon sinks or GHG sources.

RESTORE4Cs is a Horizon Europe project that aims to evaluate the effects of restoration actions on wetlands' ability to mitigate climate change and deliver a range of ecosystem services, using an integrative socio-ecological systems approach. More information is available at:
https://www.restore4cs.eu/

4 Otero, M. et al. (2024). How can coastal wetlands help achieve EU climate goals? Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.
5 Ibid.
6 RESTORE4Cs. (2025). Ria de Aveiro. RESTORE4Cs project. Available at: https://www.restore4cs.eu/case-pilots/ria-de-aveiro/.

Key implementation challenges for coastal wetlands restoration

Coastal wetland restoration in Portugal faces several implementation challenges, which relate to policy and governance issues, planning difficulties and gaps in knowledge and capacity. The table below elaborates the most important implementation challenges (dark orange cells) and other important challenges (light orange) to coastal wetland restoration in Portugal. These challenges were identified using expert knowledge of RESTORE4Cs project partners, the analysis of national policies, as well as feedback from stakeholders in the RESTORE4Cs workshops and consultations relevant to this roadmap development.

Table 2: Key challenges for implementing coastal wetland restoration in Portugal (dark orange - most important implementation challenges; light orange - other important challenges to coastal wetland restoration)

Key challenges for implementing coastal wetland restoration in Portugal	
Policy and governance	Lack of coherence between environmental policies and priorities from other sectors (Flood risk/prevention, Agricultural interests)
	Lack of policy action in estuaries: Although the Portuguese territorial planning and management system has provided for Estuary Management Plans since 2007, for 4 estuaries (Minho, Douro, Vouga and Tejo) none of these plans have yet been prepared.
	Insufficient coordination among institutions
	Slow administrative processes
Quality and quantity of data	Institutions acknowledge data quality and quantity as key challenges and are addressing them through harmonization of monitoring protocols, integration of diverse datasets, adoption of GIS-based technologies, and active collaboration with academia
Knowledge and capacity	Lack of expertise to measure co-benefits from coastal wetland restoration activities
	Insufficient financial resources
Planning and prioritisation of restoration	Conflicting land uses especially with agricultural areas
Stakeholder engagement and awareness	All major regulatory and planning instruments, including wetlands must go through public consultation on Participa[7] portal. The process is aligned with the Aarhus Convention, ensuring transparency and the right of citizens to participate in environmental decision-making. Participation is growing, but the absolute number of participants per consultation can vary widely depending on the topic, location, and perceived impact.

[7] https://participa.pt.

02

Priority topics in this roadmap

2. Priority topics in this roadmap

This pilot roadmap on coastal wetland restoration in Portugal is structured in a stepwise approach which follows a decision-making logic:

- It starts with a baseline assessment at national level, with key information on the main characteristics and conditions of coastal wetlands in Portugal and alignment of roadmap with national policies and targets.
- It them moves to the operationalisation of relevant policy targets with appropriate indicators, and the identification of potential restoration sites.
- It then proceeds to the planning of restoration actions which involves the scoping of suitable restoration techniques to increase GHG mitigation capacity of coastal wetlands, the assessment of benefits and costs as key aspect and identification of funding sources.

The roadmap elaborates on decision-making steps which have been identified as priority needs for further development in Portugal and which can benefit from the knowledge gathered in RESTORE4Cs knowledge on restoring coastal wetlands.

In two further sections, the roadmap underlines the importance of:

- a good governance structure, stakeholder participation and partnerships to support coastal wetland restoration, focusing on key stakeholders and their roles and strategies for involving local communities and stakeholders and public–private-partnerships;
- enabling capacities and increasing awareness.

Each thematic block of the roadmap is elaborated in more detailed steps which outline the main results, methods or tools from RESTORE4Cs which can be used to support authorities and practitioners in the specific step of the process.

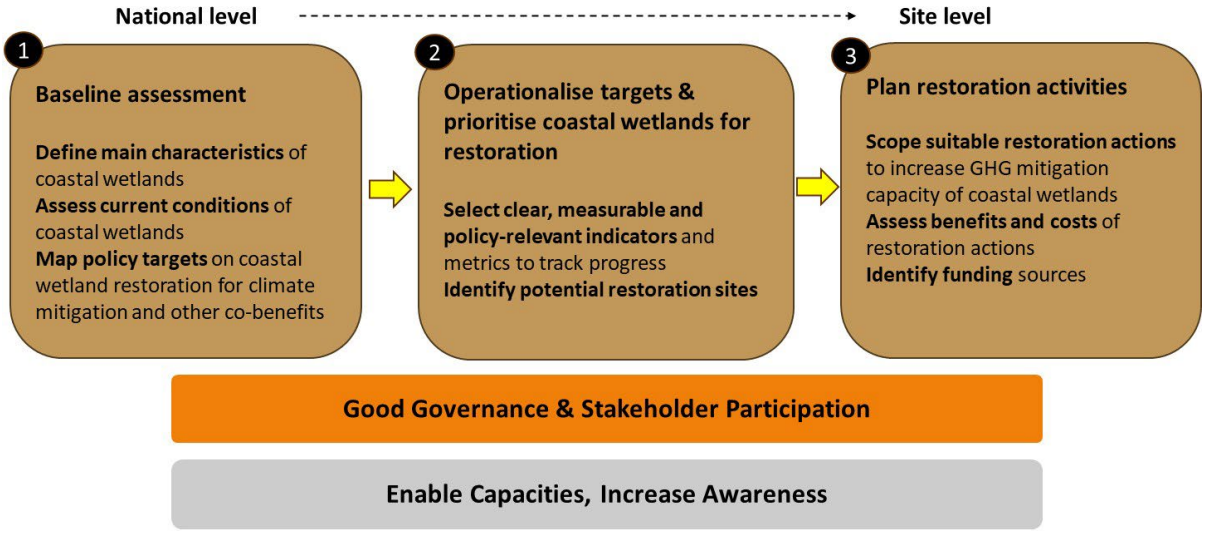
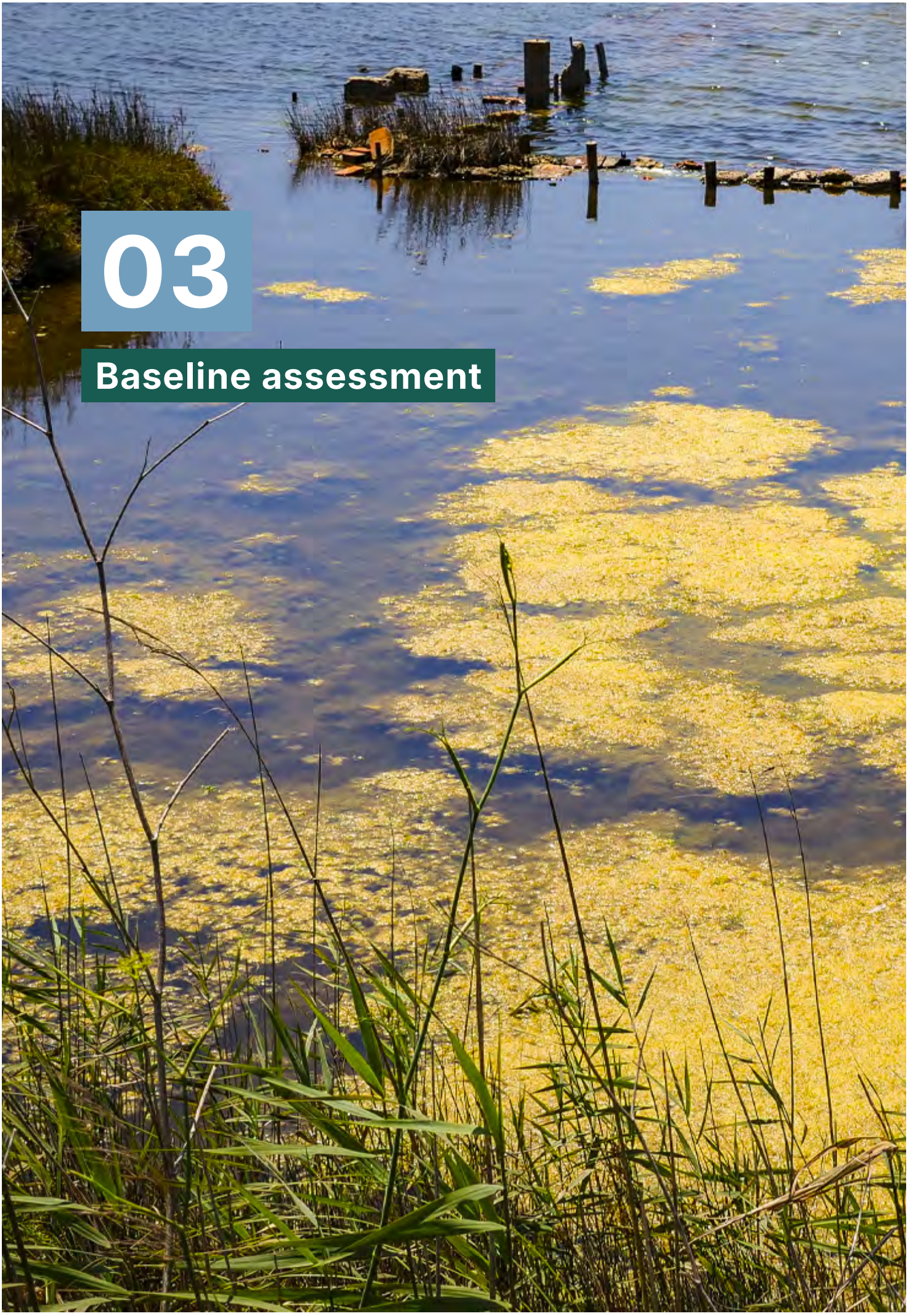


Figure 1: Structure of pilot roadmap for Portugal.



03

Baseline assessment

3. Baseline assessment

Define main characteristics of coastal wetlands

- → **Determine whether a definition of coastal wetlands exists within the national policy framework and identify if improvements are needed.**
- → **Establish the criteria for delimiting coastal areas for baseline assessment and mapping activities.**
- → **Identify the current extent of coastal wetlands and describe the habitat types present.**

Coastal Wetlands: Key Characteristics

Having the Portuguese Environmental Agency – APA and the Institute for Nature Conservation and Forests – ICNF as the main national focal points and reporting authorities to the EC, Table 3 presents official definitions of coastal wetlands from APA, ICNF, and Ramsar, including direct excerpts and sources.

Table 3: Official definitions of coastal wetlands from APA, ICNF, and Ramsar.

Institution	Reference	Official Definition (Excerpt)	Source
APA	Adopts the Ramsar Convention definition*	Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters. As zonas húmidas são áreas de pântano, charco, turfeira ou água, naturais ou artificiais, permanentes ou temporárias, com água estagnada ou corrente, doce, salobra ou salgada, incluindo as águas marinhas cuja profundidade, na maré baixa, não exceda seis metros.	APA official website https://apambiente.pt/ *Ramsar official website https://rsis.ramsar.org/
ICNF	References both the Ramsar Convention definition and the EU Habitats Directive typology	Coastal wetlands include salt marshes, salt pans, coastal lagoons, estuaries, intertidal mud and sand flats, and shallow coastal waters, as defined in the Habitats Directive (92/43/EEC) and the Ramsar Convention. As zonas húmidas costeiras incluem sapais, salinas, lagoas costeiras, estuários, zonas intertidais de lodo e areia, e águas costeiras pouco profundas, conforme definidos na Diretiva Habitats (92/43/CEE) e na Convenção de Ramsar.	ICNF official website https://www.icnf.pt/

Coastal wetlands are ecotonal ecosystems situated at the interface of terrestrial, freshwater, and marine environments. They are shaped by tidal influence, variable salinity, and periodic flooding, resulting in high ecological productivity and biodiversity. This dynamic gradient creates **brackish environments**, leading to high biological productivity and diverse flora and fauna adapted to variable salinity. They also play a vital ecological, hydrological, and socio-economic role and are particularly important in the transitional environments between marine and freshwater systems, as these areas serve as **ecotones**, supporting both marine and freshwater species, acting as nurseries for many marine organisms.

According to Portugal´s Ramsar National Report 2021 (Ramsar Convention Secretariat, 2021) [8], by 2021, there was no complete national wetland inventory. However, national inventories of specific wetland ecosystems (for instance, rivers, reservoirs, coastal areas, transitional waters, aquifers, and irrigation channels – wetlands within the framework of the WFD obligations) were in place. Still, wetland types, such as marshes, peatlands, temporary ponds, and some artificials wetlands, were not reflected. In 2021, Portugal reported that the Portuguese Environmental Agency (APA) identified more than 2,000 wetlands and 93 aquifers; out of total wetland area amounting to more than 1275,16 km^2, at least 591,91 km^2 were reported as coastal or marine wetlands (ibid.).

Wetlands are often protected under the Natura 2000 Network and Ramsar Convention. Special Protection Areas with wetlands located along the coast primarily correspond to estuaries of rivers and coastal lagoons (such as the Minho and Coura Rivers Estuaries, Ria de Aveiro, Mondego, Tagus and Sado Estuaries, Lagoa Pequena, Lagoa de Santo André, Lagoa da Sancha, Ria Formosa, and Castro Marim saltmarshes)[9]. Table 4 showcases the representative occurrence in Portugal of the habitats following the EU Habitats Directive Annex I.

Table 4: The habitat codes as used in Portuguese law (EU Habitats Directive Annex I), with English and Portuguese names, codes, and typical occurrence.

Habitat Type (English)	Habitat Type (Portuguese)	EU Habitats Directive code	Representative occurrence in Portugal
Estuaries	Estuários	1130	Ria de Aveiro, Tejo, Sado, Guadiana
Mudflats and Sandflats	Planícies de lodo e areia	1140	Ria Formosa, Aveiro, Tejo, Sado
Coastal Lagoons	Lagoas costeiras	1150	Lagoa de Óbidos, Albufeira de Mira
Salt Marshes (Atlantic)	Sapais salgados atlânticos	1310	Ria de Aveiro, Tejo, Sado, Mondego
Salt Marshes (Mediterranean)	Sapais salgados mediterrânicos	1410	Algarve, Guadiana
Salicornia and other annuals	Vegetação anual de Salicornia	1420	Ria de Aveiro, Tejo, Sado
Mediterranean salt steppes	Estepe salgada mediterrânica	1510	Algarve, Guadiana
Shallow coastal waters (<6m)	Águas costeiras pouco profundas	(Ramsar category)	Ria Formosa, Aveiro, Tejo

The primary sources for coastal wetlands information in Portugal are APA, ICNF, Ramsar, and the legal frameworks that underpin national and EU obligations. APA provides authoritative guidance on wetland typologies, ecological functions, and pressures through its official website and technical documents, including River basin Management Plans – BGRH (Planos de Gestão de Região Hidrográfica) and Coastal Zone Management Plans – POOC (Planos de Ordenamento da Orla Costeira), currently Coastal Zones Programmes – POC[10] (Programas da Orla Costeira), reflecting its mandate for water resources and coastal zone management. ICNF, as the national authority for biodiversity and Natura 2000 sites, offers official habitat descriptions and codes in management plans and Standard

8 Ramsar Convention Secretariat, 2021, Ramsar National Report to COP14. Ramsar. https://www.ramsar.org/sites/default/files/documents/importftp/COP14NR_Portugal_e.pdf.

9 Resolution of the Council of Ministers No. 115-A/2008 of July 21, 2008, Diário da República No. 139/2008, 1st series. https://files.dre.pt/1s/2008/07/13901/0000200451.pdf.

10 APA, 2024. Programas da Orla Costeira. Available at: https://apambiente.pt/agua/programas-da-orla-costeira.

Data Forms, ensuring compliance with the Habitats Directive. The Ramsar Convention, implemented in Portugal, supplies internationally recognized definitions and site-specific data on ecological character and threats, reinforcing global commitments. Finally, legal and policy frameworks such as the EU Habitats Directive, Water Framework Directive, and the National Biodiversity Strategy establish the regulatory basis for conservation and restoration. Considering these main sources, the following summarises the main characteristics of coastal wetlands in mainland Portugal.

1. Transitional Nature

- **Ecotonal Systems**: These wetlands lie between marine (saltwater) and freshwater environments, typically at river mouths, estuaries, and lagoons.
- **Salinity Gradients**: They exhibit varying degrees of salinity, from freshwater to brackish to saline, depending on tides, river inflow, and precipitation.
- **Tidal Influence**: Most Portuguese coastal wetlands are subject to tidal fluctuations, leading to alternating periods of submersion and exposure.

2. Habitat Types

Portuguese coastal wetlands include a variety of interconnected habitats, such as:

- **Estuaries:** found where rivers meet the sea, characterized by brackish water and high nutrient input. They serve as key nursery grounds for fish and invertebrates.
- **Salt Marshes:** vegetated intertidal areas dominated by halophytic (salt-tolerant) plants. They act as buffers against coastal erosion and are important sediment retention and carbon storage.
- **Mudflats and Sandflats**: intertidal areas rich in organic matter and benthic organisms, rich in invertebrates and critical feeding grounds for migratory birds.
- **Seagrass Beds:** Shallow subtidal subtidal zones (e.g., *Zostera noltei*). Found in shallow providing nursery habitat for fish and invertebrates and important for sediment stabilization and marine biodiversity.
- **Tidal Channels:** natural or man-made channels that allow tidal flow in and out of wetlands, that provide connectivity between different habitat zones and support fish nurseries and aquatic vegetation.
- **Salt Pans (Salinas)**: man-made structures for salt extraction, often integrated into natural marsh systems, that also function as habitats for birds and invertebrates.
- **Dune Systems and Coastal Lagoons:** shallow, semi-enclosed bodies of water with varying salinity, separated from the ocean by sandbars or dunes.

3. Ecological Importance

- **Biodiversity Hotspots**: Support a wide range of species including fish, birds (especially migratory waterbirds), amphibians, and specialized plants.
- **Nursery and Spawning Grounds**: Essential for the life cycles of many commercially important fish and shellfish.
- **Stopover Sites**: Key points on the East Atlantic Flyway for migratory birds.

4. Ecosystem Services

- **Flood Regulation**: Act as natural buffers, absorbing excess water during high tides or storms.
- **Water Purification**: Filter pollutants and nutrients from freshwater before reaching the sea.
- **Carbon Sequestration**: Salt marshes and seagrasses store significant amounts of organic carbon.
- **Cultural and Economic Value**: Support traditional activities like fishing, salt production, and eco-tourism.

5. Vulnerabilities and Pressures

- Urban development and land reclamation
- Pollution (e.g., agricultural runoff, nitrate rich ground water)
- Climate change impacts (sea-level rise, salinization of coastal freshwater wetlands)
- Invasive species
- Habitat Fragmentation

Support from RESTORE4Cs

Wetlands cover ~2.5% of Portugal's land area, including coastal lagoons, estuaries, and marshes. Key wetland types and the respective coverage in Portugal, as reported in 2018, are shown in Table 5, whilst a map (Figure 2) provides a comprehensive visualization of the distribution and diversity of wetland habitats across mainland Portugal, based on the Extended Wetland Layer from 2018 as compiled for the RESTORE4Cs project. The map legend on the left of Figure 2 identifies a wide range of wetland types, including inland marshes, coastal lagoons, saltmarshes, intertidal flats, lakes, ponds, reservoirs, and various riparian and forested wetland systems. Notably, the map highlights the concentration of coastal wetlands along the western and southern coastline, with significant clusters in estuarine regions like the Tagus, Sado, and Ria Formosa. The color-coded categories allow for easy identification of each habitat type, illustrating both the extent and fragmentation of wetland ecosystems. This spatial overview is essential for understanding the ecological complexity of Portugal's wetlands, informing conservation priorities, and supporting restoration planning under national and European framework.

Table 5: The Key wetland types occurring in Portugal and the respective coverage.

Coastal Wetland Habitat Type	Area (km^2)
Inland marshes	24.46
Beaches, dunes, sand	120.93
Coastal lagoons	77.2
Coastal saltpans (highly artificial salinas)	70.45
Intertidal flats	43.11
Lakes, ponds and reservoirs	65.69
Managed or grazed wet meadow or pasture	42.74
Marine waters less than six meters deep at low tide	384.1
Natural seasonally or permanently wet grasslands	11.76
Rice Fields	364.53
Riparian, fluvial and mixed forest	19.06
Riparian, fluvial and swamp broadleaved forest	33.6
Riparian, fluvial and swamp coniferous forest	8.39
River estuaries and estuarine waters of deltas	450.46
Salt marshes	189.73
Water courses	107.34
Wet heaths	1.22
	Total 2,014.8

Source: Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform.

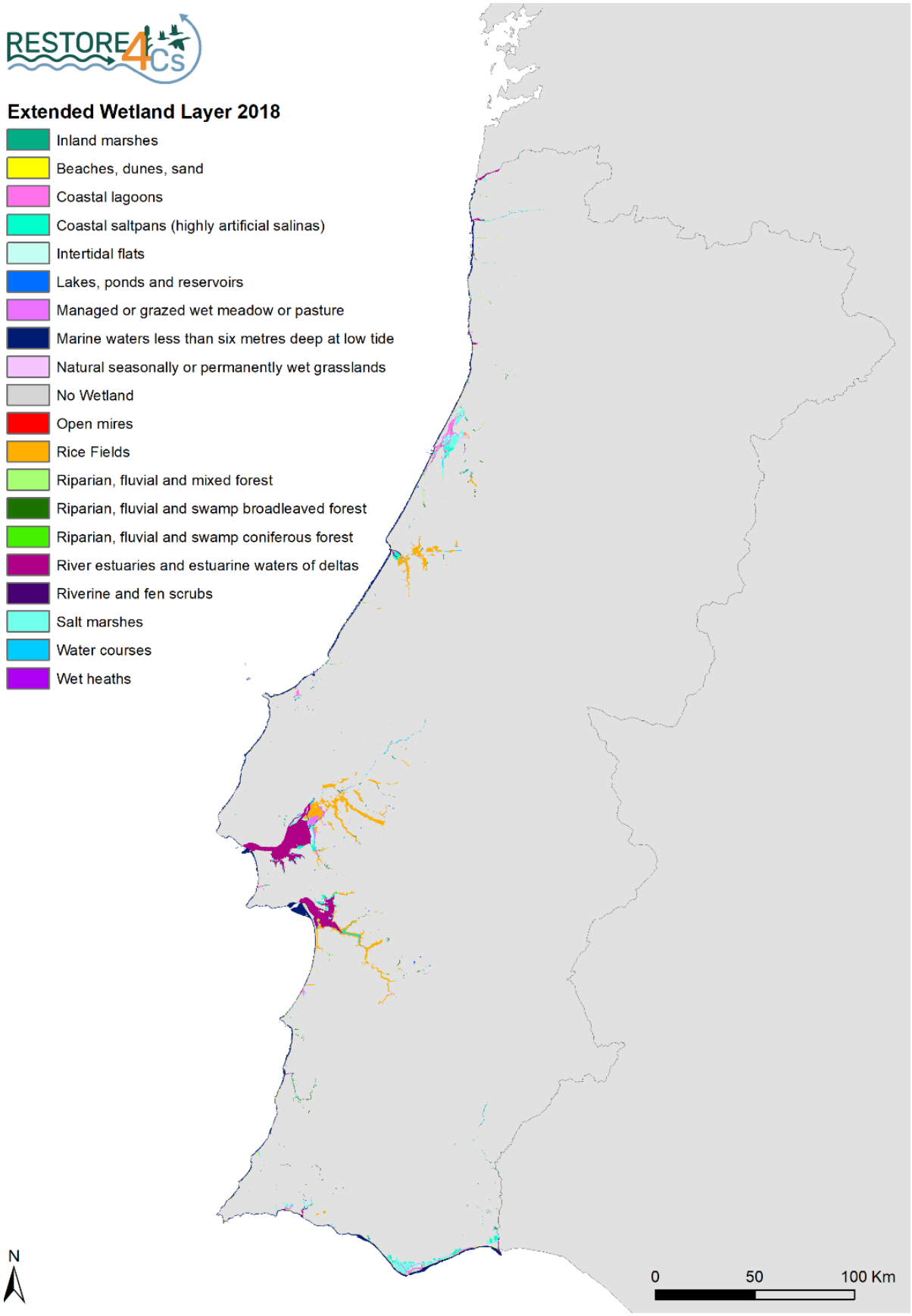


Figure 2: Map on extent of coastal wetlands in Portugal. Source: Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform (based on extended Wetland Layer).

Assess current conditions of coastal wetlands

- → **Determine the overall status of coastal wetlands.**
- → **Identify the area of coastal wetlands that is currently under protection.**
- → **Describe the main threats and pressures affecting coastal wetlands.**
- → **Verify whether a classification system exists for coastal wetlands based on their health condition.**

Coastal wetlands in Portugal are under considerable stress, primarily due to persistent erosion and associated physical pressures along the shoreline. These ecosystems—such as estuaries, lagoons, and saltmarshes—are highly sensitive to changes in sediment dynamics, sea-level rise, and human interventions. To address these challenges, APA has established comprehensive planning and monitoring frameworks that integrate coastal zone management with risk prevention and environmental safeguards. In parallel, ICNF plays a critical role in ensuring long-term ecological integrity by implementing conservation measures under Natura 2000 and fulfilling obligations of the Habitats Directive, which provide legal protection and restoration targets for priority habitats. In more detail:

- Policy & planning framework (APA): Portugal's coastal zone is managed through APA's coastal programs (POC/POOC) and long-term monitoring. These programs define protection rules for the mainland coastline, including terrestrial and marine strips, and prevail over municipal plans.
- Monitoring & diagnostics (APA): APA runs national networks and platforms (e.g., SNIRH, COSMO) to track status and trends in coastal systems, supporting licensing and policy decisions.
- Current physical pressure signal (APA REA indicator): About 50% of Portugal's low sandy coast shows an erosive trend (1958–2023), with an estimated loss of ~13.8 km² of coastal territory.
- Conservation framework (ICNF/Natura 2000): Coastal wetlands (estuaries, lagoons, saltmarshes, intertidal flats) are extensively covered by Natura 2000, Ramsar, and the National Network of Protected Areas.
- Habitats Directive context (ICNF): Annex I habitats include estuaries, coastal lagoons, saltmarshes, dunes, and rocky habitats, assessed under Article 17 reporting.

Currently, Portugal has not yet published official figures that quantify the area of coastal wetlands (or other habitats) classified as "not in good condition" under the Nature Restoration Regulation (NRR) methodology. This is because the NRR requires a new, standardized approach to assess habitat condition, which differs from previous reporting under the Habitats Directive. The process of mapping and quantifying these areas is ongoing as part of the preparation of the National Restoration Plan (NRP), which every Member State must submit by 2026–2027. Once finalized, these data will provide the baseline for restoration targets (e.g., restoring at least 30% of degraded habitats by 2030). Until then, only preliminary or indirect indicators exist, such as Article 17 conservation status, but these do not fully align with NRR requirements. In fact:

- NRR requires Member States to map habitat areas not in good condition and set restoration targets (≥30% by 2030).
- Portugal has not yet published official figures for hectares of coastal wetlands not in good condition under NRR methodology.

- ICNF's Article 17 reporting provides distribution and conservation status for Annex I habitats within Natura 2000 but does not quantify outside-Natura areas by NRR condition.
- Official figures will be available with Portugal's National Restoration Plan (NRP) deliverables (due 2026–2027).

Figure 3 map illustrates the share of coastal wetlands that falls within Portugal's Natura 2000 network (highlighted in green), as assessed in 2023. Using a color-coded scheme, the map distinguishes between coastal wetlands in Natura 2000 and thus considered as with "good" ecological condition (green), and those not covered by the Natura 2000 network (red). The spatial distribution highlights both the successes and ongoing challenges of wetland conservation within protected sites, with notable clusters of well-preserved and degraded wetlands along the coast and in major estuarine regions. This visual overview provides valuable insight into the effectiveness of Natura 2000 coverage for wetland habitats and helps to identify priority areas for restoration and improved management. In more detail:

- Douro estuary: Smaller wetland with scattered red segments reflecting high urban encroachment and river regulation impacts.
- Ria de Aveiro: Mixed condition, with green cores close to conservation zones (saltmarsh/seagrass areas) and red fringe zones radiating inland along channels, pointing to edge effects near urban/industrial areas, navigation channels, and areas with altered bathymetry.
- Mondego estuary: Similar mixed signal; localized greens adjacent to managed marsh units, reds where channel works and agriculture meet tidal flats.
- Tagus estuary: A mosaic—green clusters near core marshes and reserve subunits, contrasted by extensive red tracts along the estuarine network and floodplains. Near Lisbon, it hosts the largest urban/port complex.
- Sado estuary: Green blocks around well-conserved marshes and saltpan complexes; red spokes extend where human activities take place.
- Ria Formosa: Green condition, particularly within strictly managed cores; however, red arcs appear around inlets, navigation channels, and peri-urban shorelines. Vulnerability to coastal development, tourism infrastructure, and channel maintenance causes local condition downgrades even inside protected perimeters.

These patterns suggest that many systems show green cores of coastal wetlands as part of the Natura 2000 network surrounded by red peripheries. Meaning that core areas benefit from long-standing protection, lower disturbance and functional tidal exchange, whilst, edges suffer runoff inputs, trampling, boating, bait digging, or drainage/channelization, degrading habitat structure and functions. Red polygons radiating inland along creeks/channels indicate hydromorphological stress corridors, where water-quality, flow regulation, or embankments compromise wetland condition along connectivity axes. Discontinuous green areas separated by red strips reflect habitat fragmentation that lowers connectivity and resilience. Inside the protected perimeters pressures might result from hydromorphological modification (e.g., tidal-prism alteration), land-use change (e.g., peri-urban expansion, intensive agriculture at wetland margins), recreation and tourism activities (e.g., off-trail access, boating), biotic stressors: (e.g., invasive species), and climate-change related pressures (e.g., sea-level rise, storm surges, altered sediment budgets that erode marsh edges and drown low-elevation flats).

Figure 4 map shows the share of coastal wetlands that falls within nationally designated protected areas (highlighted in green) (such as Natural Parks, Nature Reserves, and other national conservation sites) as of 2024. The map distinguishes between coastal wetlands under nationally protected designation (color-coded as green) and coastal wetlands that do not have a national designation (color-coded red), allowing for a rapid assessment of the extent of national protection for maintaining wetland health. Namely, wetlands in the Ria de Aveiro display a mix of green and red, with green areas concentrated in core protected zones and red areas radiating along channels and floodplains. The Douro and Mondego estuaries show similar fragmentation, with small green patches surrounded by larger red zones, indicating localized protection and thus good condition but widespread degradation. The Tagus and Sado estuaries, reveal a mosaic of legal protection conditions. Green areas are found in the most strictly managed reserves, while red areas dominate the peripheries and floodplain extensions, often where urban, industrial, or agricultural pressures are highest. Southern coastal wetlands, including those in the Ria Formosa and adjacent lagoons, show some well-preserved green patches, but these are interspersed with extensive red zones, especially near developed shorelines and tourist infrastructure. Restoration efforts should focus on degraded edge zones and connectivity corridors, while ongoing monitoring is needed to fill data gaps. National programs, such as those established under Portaria n.º 442/2025/1, can help address these challenges by supporting targeted restoration, improved management, and integration of ecological monitoring into national reporting frameworks.

Birds are especially important to consider in wetland assessments because they serve as sensitive bioindicators of ecosystem health. Wetland birds respond rapidly to changes in habitat quality, hydrology, and food availability, and their population trends reflect the cumulative effects of management, restoration, and environmental pressures. Moreover, many international conservation frameworks and site designations (such as Ramsar and Natura 2000) use bird populations as key criteria for classifying and prioritizing wetlands, underscoring their central role in biodiversity monitoring and policy. Therefore, Figure 5 map displays, for each wetland polygon in mainland Portugal, the percentage of assessed wetland bird species whose short-term population trends are stable or increasing (data from 2018). The color ramp expresses these percentages: darker greens indicate areas where a larger share of the wetland bird community is performing well, while yellow and light green areas reflect mixed population trends. Orange and red would signal widespread declines, though such areas are very limited or absent on this map. It is important to note that this is a trend metric, showing the proportion of species with stable or increasing populations, not a measure of absolute abundance. A high percentage means many species are currently stable or increasing but does not necessarily indicate that populations have reached favorable sizes. In more detail, Ria de Aveiro and Mondego show moderate to good percentages along main channels and inner flats; Tagus estuary shows extensive green blocks within core marsh/saltpan complexes and state-managed units; lighter tones on urban/industrial peripheries; Sado estuary shows similar core-green/edge-lighter trend, with saltpans and shallow bays showing stable/increasing trends for several birds, whilst wetlands closer to industrial or aquaculture pressure trend lighter; Ria Formosa shows green paths, especially around saltmarsh–lagoon–saltpan mosaics.

The map in Figure 6 is labeled - *Percentage of wetland birds with increasing or stable population trends (short term) for mainland Portugal*. Conceptually, this indicator reports, for each mapped wetland polygon, the share of assessed wetland bird species who's short-term trends are either stable or increasing. As with any "trend proportion" metric, it captures direction of change rather than absolute abundance or favorable conservation status. High percentages mean "many species are holding or improving," but do not prove that populations are large enough or that demographic structures are robust. From the 2018 data, red polygons dominate the visible coastal and estuarine wetland network,

while green polygons are absent. This indicator is sensitive to recent changes and therefore useful for near-term management feedback (e.g., did a restoration or disturbance lead to immediate community-level responses?); and birds function as bioindicators integrating multiple stressors (habitat quality, hydrology, food web alterations) and are widely used to assess wetland condition under frameworks like Ramsar and Natura 2000. However, regarding species list and sample size, the percentage depends on which species were assessed and how many occur per polygon; small lists can produce volatile proportions. In addition, "short term" may mask longer-term trajectories (e.g., mild recent uptick after decades of decline). Therefore, RESTORE4Cs guidance emphasises combining trend indicators with extent/condition baselines to avoid over-interpreting single metrics.

Under Annex I of the EU Habitats Directive (Council Directive 92/43/EEC), Portugal hosts a diverse suite of coastal habitats of Community interest, including coastal lagoons, salt marshes, estuaries, and dunes, which are critical for biodiversity and ecosystem functioning. The most recent national assessment, corresponding to the 2019–2024 reporting cycle (deadline: 31 July 2025) is not yet available[11]. The latest available summary report[12] and associated data set[13], reveals that the conservation status of these habitats remains a significant concern. In more detail, table summarizes the conservation status of coastal lagoons, salt marshes, estuaries, and dunes, based on the official Article 17 reporting for the period 2007–2012. These habitats are essential for biodiversity and ecosystem functioning, yet in 2012, most were assessed as being in an unfavourable state, with trends ranging from stable to declining or unknown. Table 6 presents the main biogeographical regions, status codes, trends, and notes on the nature of any reported change, providing a clear overview for conservation planning and reporting. According to the national summary report, the main conservation measures reported were related to wetland, freshwater, and coastal habitat management, which included actions such as restoration of natural hydrology, control of invasive species, and habitat rehabilitation. Spatial planning was also a central strategy, involving land use regulation, zoning, and the establishment and management of protected areas to ensure the long-term safeguarding of these habitats. For dune systems, specific measures included dune restoration, stabilization of sand structures, replanting of native vegetation, and the management of visitor access to reduce erosion and disturbance. Additionally, ongoing monitoring and adaptive management were emphasized, particularly for sensitive habitats such as the Macaronesian Spartina swards, to track ecological changes and evaluate the effectiveness of conservation actions. These measures were designed to address the main pressures identified for these habitats, such as human disturbance, invasive species, and hydrological alterations, and to promote their recovery and sustainable management. While some improvements have been noted in protected areas under the Natura 2000 network, overall trends underscore the need for targeted restoration and adaptive management to achieve the Directive's objective of maintaining or restoring these habitats to a Favourable Conservation Status. This assessment provides a reference for implementing the EU Nature Restoration Regulation and national biodiversity strategies in the coming decade.

11 EIONET Central Data Repository. Reference portal for reporting under Article 17 of the Habitats Directive. https://cdr.eionet.europa.eu/help/habitats_art17.

12 https://www.icnf.pt/api/file/doc/35ee27cf9640fa50.

13 https://cdr.eionet.europa.eu/pt/eu/art17/envuc2hfw/AuditTrail_PT_18SET.XLSX/manage_document.

Table 6: Overview of the status of key coastal habitats in Portugal (2012).

Habitat Type	Code	Region(s)	2012 Status	Trend	Nature of Change	Notes/Implications
Estuaries	1130	Atlantic	U1–	Declining	c1	Unfavourable–inadequate, declining; method change
Coastal lagoons	1150	Atlantic	U2–	Declining	nc	Unfavourable–bad, declining
		Mediterranean	U2=	Stable	nc	Unfavourable–bad, stable
Atlantic salt meadows	1330	Atlantic/Med	U1x	Unknown	nc	Unfavourable–inadequate, trend unknown
Mediterranean salt meadows	1410	Mediterranean	U2=	Stable	nc	Unfavourable–bad, stable
Halophilous scrubs	1420	Atlantic/Med	U1=	Stable	nc	Unfavourable–inadequate, stable
Salt steppes	1510	Mediterranean	U1=	Stable	nc	Unfavourable–inadequate, stable
Spartina swards	1320	Atlantic	U1x	Unknown	nc	Unfavourable–inadequate, trend unknown
		Mediterranean	U1–	Declining	nc	Unfavourable–inadequate, declining
		Macaronesian	FV	Favourable	b1	Favourable, improved knowledge
Embryonic shifting dunes	2110	Atlantic/Mac	U1x	Unknown	nc	Unfavourable–inadequate, trend unknown
Shifting dunes (white)	2120	Atlantic/Mac	U1x	Unknown	nc	Unfavourable–inadequate, trend unknown
Fixed dunes (grey)	2130	Atlantic	U1=	Stable	nc	Unfavourable–inadequate, stable
		Mediterranean	U1–	Declining	c1	Unfavourable–inadequate, declining; method change
Wet dune slacks	2190	Atlantic/Med	U2=	Stable	nc	Unfavourable–bad, stable
Wooded dunes	2180	Atlantic	U2=	Stable	nc	Unfavourable–bad, stable

Legend: U1 = Unfavourable–inadequate; U2 = Unfavourable–bad; FV = Favourable; + = Improving, = = Stable, – = Declining, x = Trend unknown; nc = No change, c1 = Method change, b1 = Better knowledge

Although the role of coastal wetlands in climate change mitigation, through carbon sequestration in saltmarshes, seagrass beds, and other blue-carbon ecosystems, is widely acknowledged in scientific and policy discussions, Portugal has not yet published an official national quantification of this potential. This means there is no authoritative figure for how much carbon these habitats store or could sequester under restoration scenarios. While Portugal does submit annual LULUCF (Land Use, Land-Use Change and Forestry) reports to the UNFCCC, the publicly available summaries do not clearly indicate whether coastal wetlands are explicitly accounted for as a separate category within the

inventory. Detailed breakdowns may exist in technical Common Reporting Format (CRF) tables, but they are not highlighted in APA's public documentation, leaving uncertainty about the extent to which these ecosystems are integrated into national greenhouse gas accounting. The very recent Portaria n.º 442/2025/1[14] establishes the "Floresta Azul" program for the ecological restoration of seagrass meadows (pradarias marinhas), which are recognized as critical blue-carbon habitats in Portugal. The Portaria highlights the importance of these ecosystems for carbon sequestration, biodiversity, sediment stabilization, and coastal protection. It mandates mapping, ecological monitoring, and quantification of carbon sequestration capacity, aiming to integrate seagrass meadows into the National Emissions Inventory in line with IPCC guidance. The program supports restoration actions, research, and public engagement, and is aligned with national climate and biodiversity strategies, including the National Restoration Plan and the Carbon Neutrality Roadmap 2050. Financial support is provided through the Environmental Fund, with €2 million allocated for 2026–2027. The Portaria thus marks a significant step toward the official recognition and quantification of blue-carbon mitigation potential in Portugal's coastal wetlands, particularly seagrass meadows, and their future integration into national climate reporting frameworks. In more detail:

- Until recently, no official national synthesis quantifying the blue-carbon mitigation potential of saltmarshes and seagrass meadows had been published by APA or ICNF.
- Portaria n.º 442/2025/1 establishes the "Floresta Azul" program, mandating mapping, ecological monitoring, and quantification of carbon sequestration in seagrass meadows, with the goal of integrating these data into the National Emissions Inventory.
- Portugal continues to report LULUCF annually to UNFCCC (APA is the competent authority), but public summaries have not yet confirmed explicit inclusion of coastal wetlands as a separate quantified category.
- Detailed breakdowns may exist in technical CRF tables, but these are not highlighted in APA's public documentation.
- Official blue-carbon research outputs have mostly been project-based or academic, but the new program under Portaria n.º 442/2025/1 aims to generate standardized, policy-relevant data for national reporting and restoration planning.

14 Portaria n.º 442/2025/1. Diario da Republica. No. 239. 12-12-2025. https://files.diariodarepublica.pt/1s/2025/12/23900/0001000012.pdf.

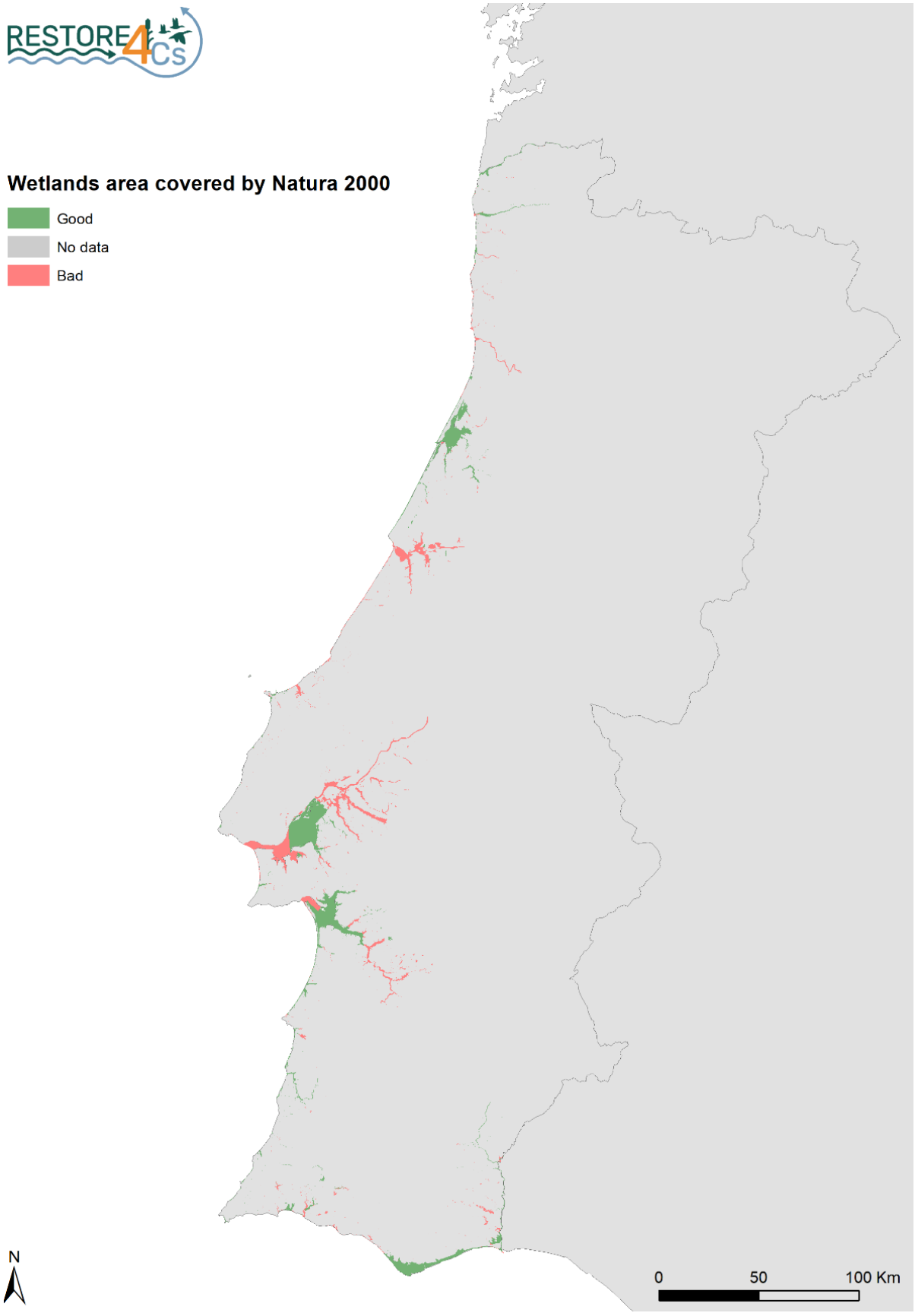


Figure 3: Coastal wetlands area covered by Natura 2000 (2023) (Green colour (Good)=Wetland protected by Natura 2000; Red colour (Bad)=Wetland not protected by Natura 2000). Source: Extent and Condition Indicators Tool on the European Coastal Wetlands Interactive Platform.

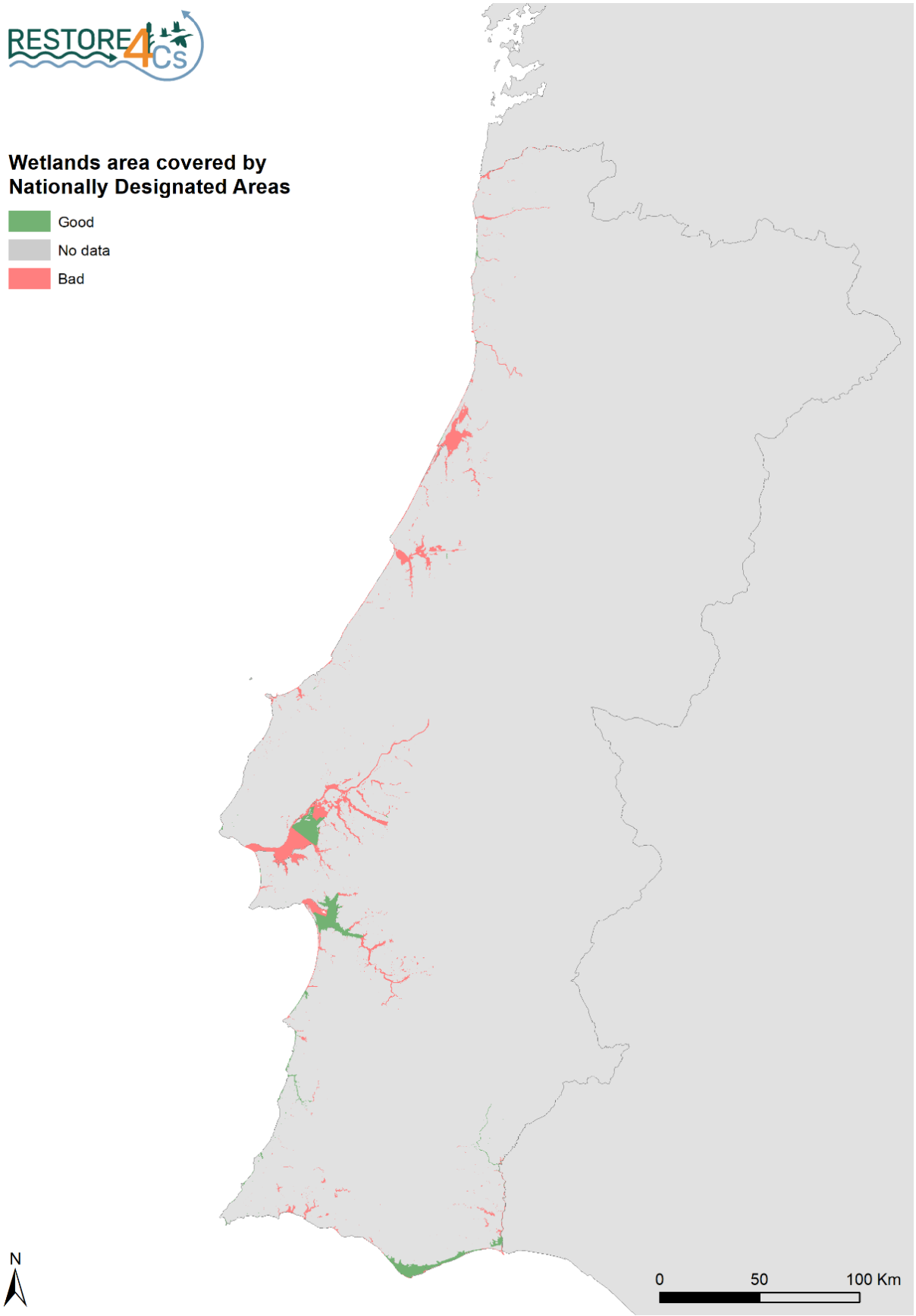


Figure 4: Coastal wetlands area covered by Nationally Designated protected areas (Green colour (Good)=Wetland protected by national designated areas; Red colour (Bad)=Wetland not protected by national designated areas). Source: Extent and Condition Indicators Tool on the European Coastal Wetlands Interactive Platform.

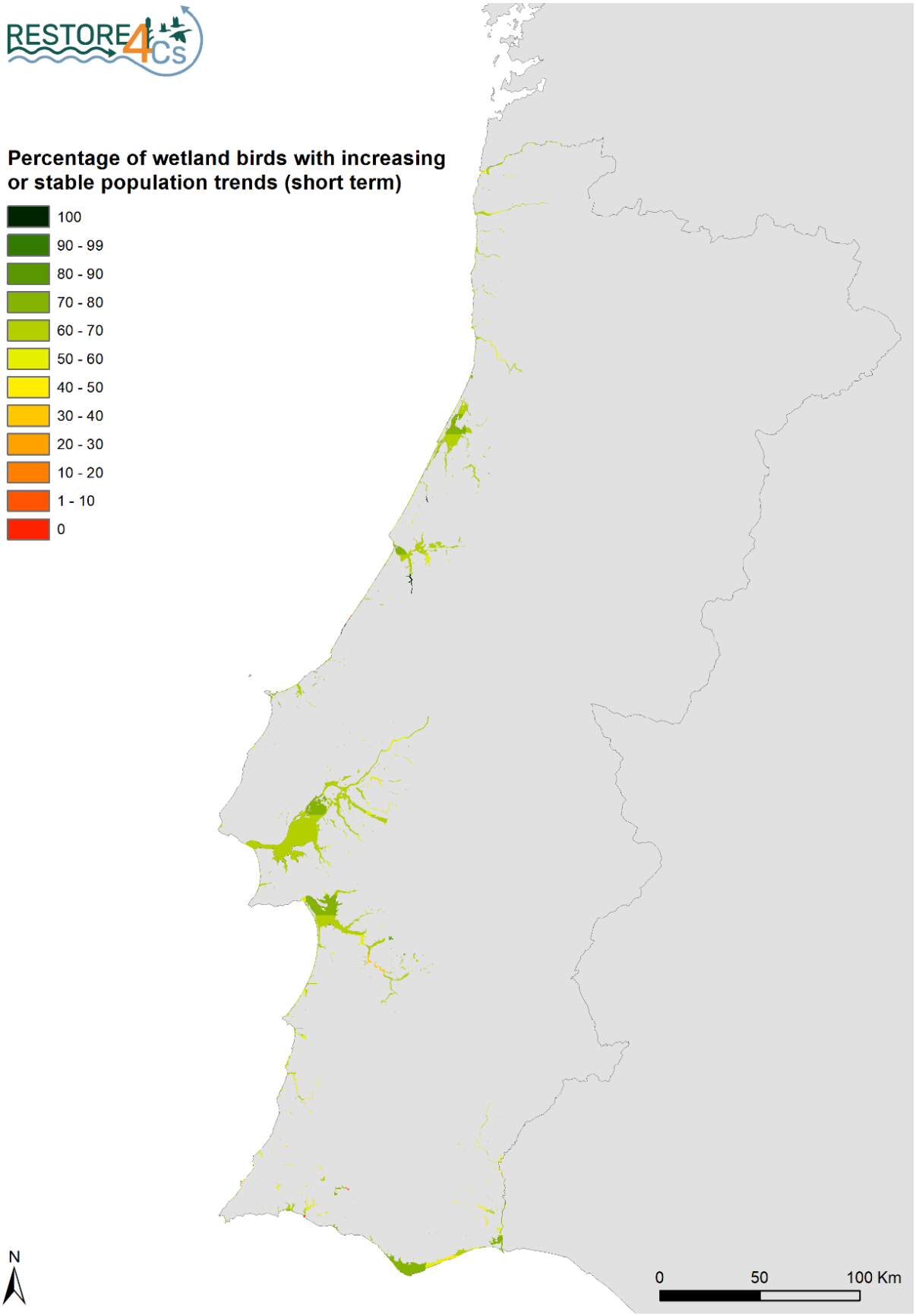


Figure 5: Percentage of Wetland Birds with Increasing or stable population trends (short term) in Portugal mainland (2018). Source: University of Malaga.

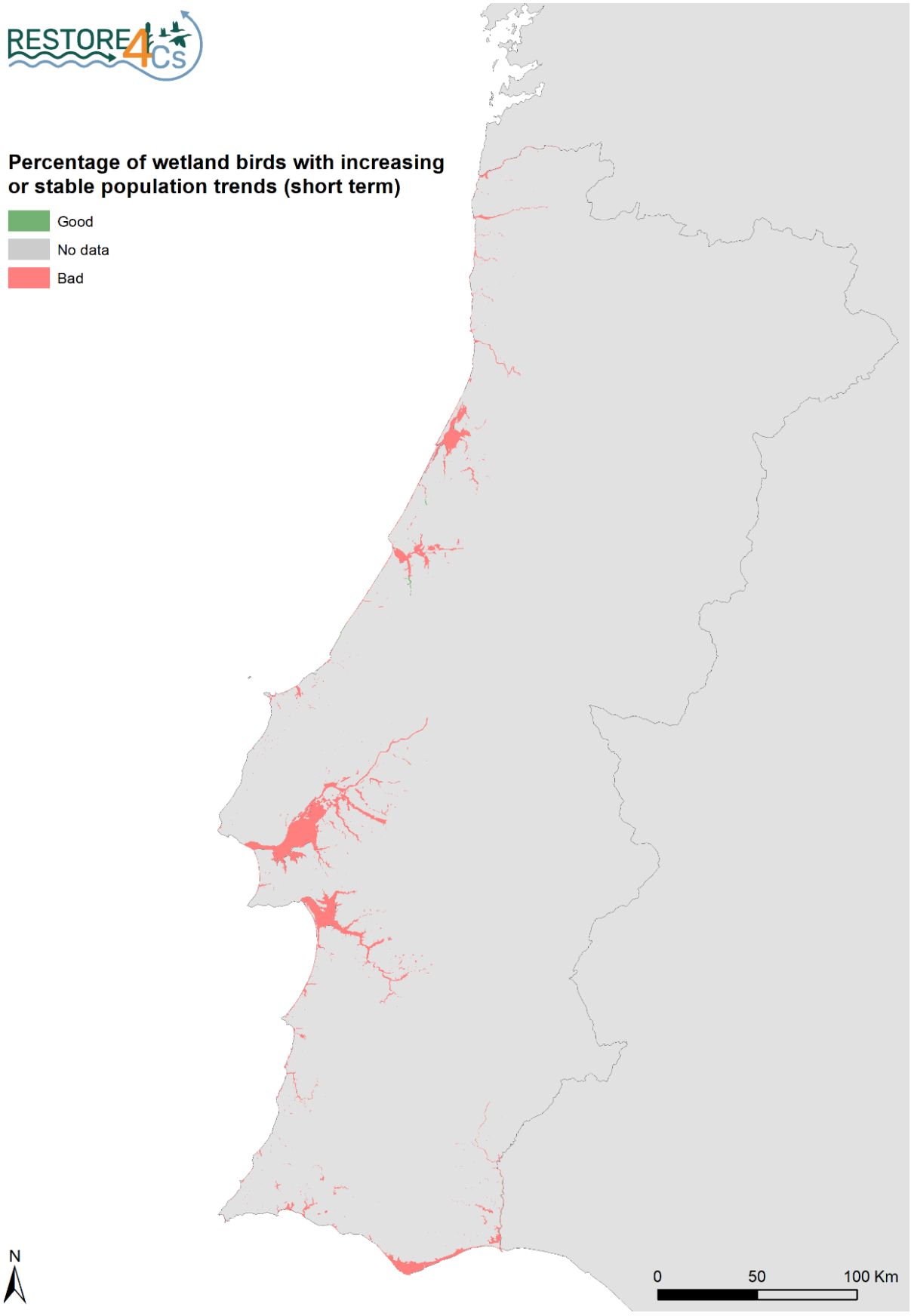


Figure 6: Percentage of wetland birds with increasing or stable population trends (short term) in Portugal mainland (2018). Source: University of Malaga.

Key recommendations

→ Accelerate NRR-compliant assessments by **completing the mapping of coastal wetlands** classified as 'not in good condition,' including areas outside Natura 2000 and integrate multi-source data into a unified monitoring framework to improve accuracy and close existing gaps.

→ **Focus efforts to restore ecological integrity on fragmented and degraded peripheries of estuaries and lagoons**, such as Tagus, Sado, and Ria de Aveiro, where connectivity and ecosystem functions are most compromised. Restoration should prioritize nature-based solutions to enhance resilience to climate change.

→ APA and ICNF should **harmonize coastal zone management, Natura 2000 obligations, and NRR targets under a single strategic framework** to strengthen governance and funding.

→ Ensure **rapid implementation of Portaria n.º 442/2025/1 ("Floresta Azul" program) for seagrass restoration**, including mapping, carbon sequestration quantification, and integration into the National Emissions Inventory. Beyond seagrass, the scope should expand to include saltmarshes and other coastal wetlands in blue-carbon accounting. Authorities should also clarify and standardize the inclusion of these ecosystems in national greenhouse gas inventories, aligning with IPCC guidance and LULUCF reporting.

Map policy targets for coastal wetland restoration for climate change mitigation and other co-benefits

- → **Identify relevant national policies that address the restoration and conservation of coastal wetlands and specify any embedded restoration targets.**
- → **Assess the degree of alignment between national policy targets and EU/global commitments on wetland restoration and climate change mitigation.**
- → **Evaluate opportunities to operationalise higher-level policy targets into actionable measures that support coastal wetland restoration.**

In mainland Portugal, there is no dedicated wetlands policy, wetlands are rather covered by various policy instruments in different policy fields: climate change mitigation and adaptation; nature and biodiversity; and water, marine and coastal protection. The same applies to management plans. Relevant examples are showcased in Table 7.

Table 7: Examples of Portuguese coastal wetland systems and the associated management plans.

Coastal Wetland System	Type	Coastal/Estuarine Management Plan (URL)	River Basin Management Plan (URL)
Ria de Aveiro (Vouga Estuary)	Coastal lagoon	POC Ovar – Marinha Grande: https://apambiente.pt/agua/programas-da-orla-costeira	PGRH Vouga, Mondego e Lis: https://leap.unep.org/en/countries/pt/national-legislation/council-ministers-resolution-no-622024-approving-river-basin
Ria Formosa (Algarve)	Barrier-island lagoon	POC Odeceixe – Vilamoura: https://apambiente.pt/agua/programas-da-orla-costeira	PGRH Ribeiras do Algarve: https://leap.unep.org/en/countries/pt/national-legislation/council-ministers-resolution-no-622024-approving-river-basin
Tagus Estuary	Estuary	POC Alcobaça – Cabo Espichel: https://apambiente.pt/agua/programas-da-orla-costeira	PGRH Tejo e Ribeiras do Oeste: https://leap.unep.org/en/countries/pt/national-legislation/council-ministers-resolution-no-622024-approving-river-basin
Sado Estuary	Estuary	POC Espichel – Odeceixe: https://apambiente.pt/agua/programas-da-orla-costeira	PGRH Sado e Mira: https://leap.unep.org/en/countries/pt/national-legislation/council-ministers-resolution-no-622024-approving-river-basin
Lagoa de Óbidos	Coastal lagoon	POC Alcobaça – Cabo Espichel: https://apambiente.pt/agua/programas-da-orla-costeira	PGRH Vouga, Mondego e Lis: https://leap.unep.org/en/countries/pt/national-legislation/council-ministers-resolution-no-622024-approving-river-basin

The following summarises the main policy instruments considered for the management coastal wetlands in mainland Portugal.

Climate change mitigation and adaptation

The Basic Climate Law[15] (2021) indirectly supports wetland restoration through setting the objectives to develop and reinforce current carbon sinks and other carbon sequestration services

15 Law No. 98/2021 of December 31, 2021, Diário da República No. 253/2021, 1st series. https://files.dre.pt/1s/2021/12/25300/0000500032.pdf

and protect and promote the regeneration of biodiversity, ecosystems and services. Also, the Law establishes the obligation for the State to respect the EU taxonomy in public investment and procurement by 2030 (GRI at the LSE & Climate Policy Radar, n.d.)[16], which also implies the support for wetland restoration activities qualified as sustainable under the EU Taxonomy requirements.

The **National Strategy for Adaptation to Climate Change 2025 (ENAAC)[17] (2015)** sets out objectives and a framework for implementing climate adaptation solutions across different sectors, including agriculture, biodiversity, economy, forests, human health, security of people and goods, coastal zones. Although coastal wetlands are not specifically mentioned, these provisions lay the basis for their conservation. The **Action Programme for Adaptation to Climate Change (P-3AC)[18] (2019)** further complements and systematises the work undertaken under this Strategy, implementing adaptation measures for the 2019-2030 period. There are a few main objectives that can support coastal wetland conservation:

- reduce the risk of coastal flooding;
- ensure a more resilient coastline to erosion, overgrowth and coastal flooding phenomena, especially in built-up areas and/or urban centres;
- ensure sedimentary replenishment, including high magnitude artificial operations and the operationalisation of processes promoting the natural restoration of sedimentary transit from river basins;
- maintain or restore natural transition zones between coastal and terrestrial ecosystems.

The **National Energy and Climate Plan 2030 (PNEC 2030)[19] (2024)** may support coastal wetland restoration through actions targeting coastal resilience and protection, although wetland-related measures are not explicitly addressed in the Plan. The Plan also includes actions targeting the restoration of agricultural soils (Section 6.5.3), such as the restoration of riparian galleries, which can benefit wetlands impacted by agricultural activities. Furthermore, under the "Promoting tools to enhance climate action" line of action, the NECP calls for identifying, within the state budget, measures that contribute to the implementation of the main policy instruments for each of the six objectives of the EU Taxonomy, in which (coastal) wetland restoration is listed as an activity qualifying as sustainable.

Long-Term Strategy for Carbon Neutrality of the Portuguese Economy by 2050 (Roadmap for Carbon Neutrality or RNC 2050) (2019) outlines the pathway for Portugal's energy transition and economic decarbonisation by 2050, aiming to identify and assess pathways that are technically feasible, economically viable, and socially accepted. It recognises the need for a substantial **increase in national carbon sinks**. Wetlands are identified as sources of emissions, with projections indicating an 8% reduction in emissions from these areas by 2050. However, coastal wetlands are not specifically mentioned.

Portaria n.º 442/2025/1 ("Floresta Azul" Program), adopted in 2025, establishes a national framework for the ecological restoration of seagrass meadows as critical blue-carbon habitats.

16 GRI at the LSE & Climate Policy Radar, n.d., Framework climate law no 98/2021. Climate Change Laws of the World. https://climate-laws.org/document/framework-climate-law-no-98-2021_2801.

17 Decree of the President of the Republic no. 88/2015 of July 30, 2015, Diário da República No. 14/2015, 1st series. https://files.diariodarepublica.pt/1s/2015/07/14700/0511405168.pdf.

18 Resolution of the Council of Ministers no. 130/2019. Diário da República No. 147/2019, 1st series. https://dre.pt/application/conteudo/123666112.

19 EC (2024). Portugal – Final updated National Energy and Climate Plan (NECP) 2021-2030 (submitted in 2024). https://commission.europa.eu/document/download/f12fd5f8-605b-481c-9690-6b86fe2d48e3_en?filename=Final%20NECP_20241118_pnec2030_para_aprov_ar_EN.pdf.

The program mandates comprehensive mapping, ecological monitoring, and quantification of carbon sequestration capacity, aiming to integrate these ecosystems into Portugal's National Emissions Inventory in line with IPCC guidelines. It emphasizes the role of seagrass restoration in climate mitigation, biodiversity conservation, and coastal protection. Although primarily focused on seagrass, the Portaria signals a strategic shift toward recognizing coastal wetlands as nature-based solutions for carbon neutrality and resilience under national climate and biodiversity policies.

Nature and Biodiversity

The **Legal Regime of Nature and Biodiversity Preservation[20] (2008)** implements the Nature Preservation Fundamental Network covering: the National Network of Protected Areas, requiring the adoption of specific Programmes of the Protected Areas; the areas integrated with Natura 2000 Network, which **includes significant percentage of wetlands** (Ramsar Convention Secretariat, 2021)[21], and other areas protected under international agreement, including wetlands designated as Ramsar Sites. This Decree-Law also emphasises the need to maintain the protected status of wetlands designated as such. Many Ramsar sites, however, lack effective management plans complicating necessary conservation of wetlands (Ramsar Convention Secretariat, 2025)[22].

The **Legal Regime of the Preservation of Natural Landscapes and Wild Flora and Fauna[23] (1999)** implements the EU Birds and Habitats Directives, primarily to establish and maintain the Natura 2000 Network. While it covers various flora and fauna species, it sets out specific regulations for priority species requiring the highest levels of protection. This legislation establishes Special Protection Areas and Special Areas of Conservation, governed by targeted regulations to safeguard or restore the conservation status of specific bird species and natural habitats or species populations, respectively (Louro e Costa & de Soet Palmeiro, 2023)[24]. As many wetlands fall within this network, they benefit from these protection measures.

The **National Strategy for Nature Conservation and Biodiversity 2030 (ENCNB 2030)[25]** explicitly acknowledges the **importance of wetlands** and their ecosystem services, noting that **around ¾ of Portugal's wetlands** and **coastal area**s fall within **classified protection zones**. It prioritises restoring ecosystems that enhance risk resilience, encouraging the recovery and rehabilitation of affected areas. Particularly important is the promotion and restoration of **connectivity between terrestrial ecosystems, through green infrastructure, and aquatic (freshwater and transitional) and marine ecosystems**. The Strategy also supports expanding the Natura 2000 Network to the marine environment, to protect specific species and natural habitats. While coastal wetlands are not mentioned directly, these provisions support their conservation covering areas where these ecosystems are found.

20 Decree-Law No. 142/2008 of July 24, 2008, Diário da República, No. 14/2008, 1st series. https://faolex.fao.org/docs/pdf/por188869original.pdf.
21 Ramsar Convention Secretariat, 2021, Ramsar National Report to COP14. Ramsar. https://www.ramsar.org/sites/default/files/documents/importftp/COP14NR_Portugal_e.pdf
22 Ramsar Convention Secretariat, 2025, Ramsar National Report to COP15. Ramsar. https://www.ramsar.org/sites/default/files/2025-03/COP15NR_Portugal_e.pdf.
23 Decree-Law No. 140/99 of April 24, 1999. https://www.pgdlisboa.pt/leis/lei_mostra_articulado.php?nid=3096&tabela=leis&so_miolo=S
24 Louro e Costa, J., & de Soet Palmeiro, J., 2023, Portugal: Environment. In J. M. Auslander & B. J. Detterman (Eds.), Environment. Lexology. Getting the deal through. London: Law Business Research.
25 Resolution of the Council of Ministers No. 55/2018 of April 5, 2018, Diário da República, No. 87/2018, 1st series. https://faolex.fao.org/docs/pdf/por183922.pdf.

The Sectoral Plan of Natura 2000 Network[26] (2008) identifies species and habitats in need of restoration, delineating their locations and highlighting sites of significance for these species and habitats. It prioritises species classified as endangered according to Portugal´s Red List, identifying the sites crucial for their conservation. However, the Sectoral Plan lacks specific targets for population sizes or habitat areas, so the specifications need to be incorporated in the spatial planning plans (PMOT) and the special plans (PEOT) of municipalities[27] while transposing management measures provided in the Sectoral Plan for Natura 2000 Network.

The Sectoral Plan provides a definition of a **"wetland restoration"**. Recognising wetland management as highly relevant, it acknowledges the richness and fragility of dunes, cliffs, estuaries, coastal lagoons, and other coastal areas. It prescribes to protect coastal wetlands within particular sites under protection as well as restore wetlands that provide habitat for protected species.

Water, Marine and Coastal Protection

The **Water Law[28] (2005)** establishes the basis for the sustainable water management, considering fragile aquatic ecosystems. It aims to:

- prevent further degradation, protect and improve the status of terrestrial and aquatic ecosystems, as well **as wetlands directly dependent on these aquatic ecosystems**, with respect to their water needs;
- promote sustainable water use, based on long-term protection of available water resources;
- achieve enhanced protection and improvement of the aquatic environment, including through specific measures for the gradual reduction and cessation or phase-out of discharges, emissions and losses of priority substances;
- ensure the gradual reduction of groundwater pollution and prevent the worsening of groundwater pollution;
- mitigate the effects of floods and droughts;
- ensure the supply of sufficient quantities of good quality surface- and groundwater as necessary for a sustainable, balanced and equitable use of water;
- protect the sea waters.

Aligned with the Water Law, the **National Water Plan[29]** serves as a sectoral policy instrument supporting the fundamental water management objectives under the Water Law (Lei n.º 58/2005), which transposes the EU Water Framework Directive (Directive 2000/60/EC) into Portuguese law, and relevant international agreements. In addition to the National Water Plan, the **River Basin Management Plans[30]** – PGBH (Planos de Gestão de Bacias Hidrográficas) were established as the main operation tool to support the achievement of the set objectives. These plans explicitly include wetlands in their scope aiming to prevent degradation and improve the

26 Resolution of the Council of Ministers No.115-A/2008 of July 21, 2008, Diário da República, No. 13/2008, 1st series. https://files.dre.pt/1s/2008/07/13901/0000200451.pdf.

27 Kruk, R. W., De Blust, G., Apeldoorn, R.C., Bouwma, I. & Sier, A., 2009, Organising the management of Natura2000 sites in 27 EU Member States (Summary). https://www.miteco.gob.es/content/dam/miteco/es/biodiversidad/publicaciones/management_n20 00_tcm30-197177.pdf.

28 Law No. 58/2005 of December 29, 2005, Diário da República, No. 249/2005, 1st series. https://dre.tretas.org/dre/192805/lei-58-2005-de-29-de-dezembro.

29 Decree-Law No. 76/2016 of November 9, 2016, Diário da República no. 215/2016, 1st series. https://faolex.fao.org/docs/pdf/por184843.pdf.

30 Ordinance No. 1284/2009 of October 19, 2009, Diário da República no. 202/2009, 1st series. https://dre.tretas.org/dre/262682/portaria-1284-2009-de-19-de-outubro.

health status of water bodies and associated ecosystems, recognizing wetlands as essential for hydrological regulation, water quality, and biodiversity conservation. Wetlands are integrated into PGBH through their identification as protected areas, the establishment of restoration measures, and alignment with networks such as Natura 2000 and Ramsar sites. Despite this formal inclusion, official reports from APA highlight persistent challenges in implementation due to pressures from agriculture, urban development, and infrastructure, which demand integrated and participatory management to ensure effective protection of these ecosystems[31].

The Special Programmes for Public Water Reservoirs (POAAP) established under the Water Law have a strategic character, binding the Public Administration and individuals. They aim to protect and enhance water resources, such as reservoirs, lagoons, and public lakes, and their surrounding terrestrial protection zones.

Three types of classification of public water reservoirs are established for the purposes of this regime, based on their characteristics: protected use reservoirs, restricted use reservoirs, and free use reservoirs. In this way, POAAPs, providing comprehensive protection and management for water-related natural resources, can, in principle, cover coastal wetlands connected to freshwater reservoirs, such as estuaries or coastal lagoons.

The **Coastal Management Programmes (POCs)**[32] frame the planning and management of the coastal resources, focusing on the protection and biophysical integrity of the space, the conservation of environmental and landscape values and the balanced sustainable development. POCs cover areas to include two buffer zones:

- The **terrestrial buffer zone** – a coastal land strip at least 500 m wide, extending inland from the shoreline. It may be up to 1000 m wide to protect coastal systems such as dunes, fossil cliffs, coastal lagoons, for example, and inherent dynamics.
- The **maritime buffer zone** – the water area from the foreshore edge to the 30 m bathymetry line (Cavaco et al., 2021)[33].

The protection norms established by POCs cover: the prevention of coastal risks, e.g., erosion of sandy soils or floods and wave over topping; the protection of natural assets by designating various areas and protection levels within these buffer zones; the water resources management.

The **National Strategy for Integrated Coastal Zone Management** – ENGIZC (Estratégia Nacional de Gestão Integrada da Zona Costeira)[34] (2009) is based on a systemic approach and the valorisation of its resources and identity values, supported by knowledge, managed according to a model articulating institutions, policies, and instruments and ensuring the participation of the different stakeholders.

The following thematic objectives relevant for coastal ecosystems are set out:

- Conserve and enhance resources and natural, cultural and landscape heritage;

31 APA, 2024. Planos de Gestão de Região Hidrográfica. Available at: https://apambiente.pt/agua/planos-de-gestao-de-regiao-hidrografica.

32 Law No. 31/2014 of May 30, 2014, Diário da República no. 104/2014, 1st series. https://diariodarepublica.pt/dr/detalhe/lei/31-2014-25345938.

33 Cavaco, C., Mourato, J., Costa, J.P., Pereira, A., Vilares, E., Moreira, P. & Magalhães, M., 2021, Spatial Planning and Regional Development in Portugal. Lisboa: Direção-Geral do Território.

34 Resolution of the Council of Ministers No. 82/2009 of September 8, 2009, Diário da República no. 174/2009, 1st series. https://files.diariodarepublica.pt/1s/2009/09/17400/0605606088.pdf.

- Anticipate, prevent and manage situations of risk and impacts of an environmental, social and economic nature;
- Promote the sustainable development of wealth-generating activities that contribute to the enhancement of specific resources of the coastal zone;
- Deepen scientific knowledge about coastal systems, ecosystems and landscapes.

This strategy is highly relevant because it provides the overarching framework for sustainable coastal governance, complementing PGRH, POC, and Ramsar obligations. It was approved by Resolution of the Council of Ministers No. 82/2009 and aligns with EU Recommendation 2002/413/CE on Integrated Coastal Zone Management (ICZM). Its objectives include conserving natural resources, managing risks, and ensuring integrated planning with stakeholder participation.

The **Portuguese Ocean Strategy 2021–2030** - ENM (Estratégia Nacional para o Mar)[35], approved by Resolution of the Council of Ministers No. 68/2021, establishes a long-term vision for sustainable ocean governance aligned with the United Nations Sustainable Development Goal 14 (Life Below Water) and the European Maritime Policy. It is structured around 10 strategic objectives, including:

- Restoring and conserving marine and coastal ecosystems,
- Combating climate change and ocean acidification,
- Promoting the responsible and sustainable use of marine resources.

Under Strategic Objective 1 – Ocean Health, ENM 2030 prioritizes actions such as ecosystem restoration, biodiversity protection, and integrated coastal management, which directly benefit coastal wetlands like estuaries, saltmarshes, and lagoons. These habitats are recognized as critical for carbon sequestration (blue carbon), shoreline stabilization, and biodiversity conservation. The strategy's Action Plan (185 measures) includes initiatives for marine spatial planning, habitat restoration, and pollution reduction, all of which contribute to improving the ecological status of wetlands located in transitional zones between land and sea. By linking climate adaptation, ecosystem resilience, and sustainable resource use, ENM 2030 reinforces the role of wetlands as nature-based solutions for mitigating climate impacts and supporting socio-economic activities dependent on healthy coastal ecosystems.

Table 8 outlines specific legal obligations governing coastal wetlands in Portugal considering Climate change mitigation and adaptation, Nature and Biodiversity, and Water, Marine and Coastal protection policy instruments, while Table 9 complements this by highlighting the policy targets and objectives most critical for coastal wetland restoration.

35 Resolution of the Council Ministers No. 68/2021 of May 6, 2021, Diário da República no. 108/2021, 1st series. https://www.portugal.gov.pt/download-ficheiros/ficheiro.aspx?v=%3d%3dBQAAAB%2bLCAAAAAAABAAzNLQwsQQAODaj3AUAAAA%3d

Table 8: Overview of key national instruments addressing climate change mitigation and adaptation, nature and biodiversity, and water, marine and coastal protection, highlighting their relevance to wetlands and alignment with EU and global frameworks.

Instrument	Identification & Mapping	Environmental Objectives	Program of Measures	Monitoring & Reporting	Stakeholder Involvement	Public Consultation	Main Responsible Institution
Climate change mitigation and adaptation							
Action Programme for Adaptation to Climate Change (P-3AC, 2019)	No explicit mapping of wetlands; focuses on risk zones and coastal vulnerability areas.	Reduce climate risks, including coastal flooding; restore transition zones.	Adaptation measures for hydro-sedimentary management and ecosystem resilience.	Periodic evaluation under ENAAC framework	Multi-sectoral coordination promoted.	Public participation through ENAAC governance.	APA
National Energy and Climate Plan 2030 (PNEC 2030, 2024)	No direct wetland mapping; integrates land-use and carbon sink strategies.	Achieve climate neutrality; enhance carbon sinks including ecosystems.	Measures for renewable energy, land-use efficiency, and ecosystem services.	Annual progress reports to EU and national authorities.	Stakeholder engagement in energy-climate governance.	Formal consultation during plan preparation.	DGEG – Direção-Geral de Energia e Geologia
Long-Term Strategy for Carbon Neutrality (RNC 2050)	No specific wetland mapping; recognizes role of ecosystems in carbon neutrality.	Achieve carbon neutrality by 2050; protect and restore ecosystems.	Nature-based solutions including wetland restoration for carbon sequestration.	Monitoring aligned with climate neutrality milestones.	Stakeholder involvement in long-term planning.	Public consultation during strategy development.	APA and DGEG under Ministry of Environment and Climate Action
Portaria n.º 442/2025/1 ('Floresta Azul' Program)	Mandates mapping of seagrass meadows.	Enhance carbon sequestration and biodiversity.	Restoration actions for seagrass ecosystems.	Ecological monitoring and carbon quantification integrated into national inventory.	Collaboration with research institutions and NGOs.	Required under national restoration planning.	APA
Nature and biodiversity							
Legal Regime of Nature and Biodiversity Preservation (2008)	Mandatory identification of protected areas and habitats, including wetlands.	Conserve biodiversity and natural habitats; prevent degradation.	Management plans for classified areas; restoration measures.	Monitoring obligations for protected areas.	Participation of NGOs and local authorities.	Public consultation for classification and plans.	ICNF
Legal Regime of Preservation of Natural Landscapes and Wild Flora and Fauna (1999)	Identification of natural landscapes and species habitats.	Preserve natural landscapes and wild species.	Restrictions on land use; conservation measures.	Monitoring through ICNF and regional authorities.	Stakeholder involvement in designation processes.	Public consultation required for designation.	ICNF
National Strategy for Nature Conservation and Biodiversity 2030 (ENCNB 2030)	Strategic mapping of priority habitats including wetlands.	Stop biodiversity loss; restore ecosystems.	Action plans for habitat restoration and connectivity.	Periodic reporting under EU Biodiversity Strategy.	Broad stakeholder engagement in strategy implementation.	Public consultation during strategy approval.	ICNF and APA
Sectoral Plan of Natura 2000 Network (2008)	Detailed mapping of Natura 2000 sites including coastal wetlands.	Maintain or restore favorable conservation status of habitats.	Site-specific management measures; restoration actions.	Monitoring under Habitats Directive obligations.	Stakeholder involvement in site management.	Public consultation during plan preparation.	ICNF

Water, Marine and Coastal Protection							
River Basin Management Plans (PGRH)	Identification of water bodies and associated ecosystems, including wetlands.	Achieve good ecological status; prevent deterioration of aquatic ecosystems.	Restoration of degraded wetlands; pollution control; connectivity improvements.	Continuous monitoring; six-year reporting.	Mandatory involvement of water users and NGOs.	Formal public consultation phases during preparation.	APA
Coastal Zone Programs (POC)	Mapping of coastal biophysical systems including dunes, estuaries, and wetlands.	Safeguard natural resources and ecological integrity of coastal systems.	Normative measures restricting land use; habitat protection.	Monitoring of coastal dynamics; APA enforcement.	Engagement of municipalities and local communities.	Public participation required in drafting and revising POC.	APA
Ramsar Convention	Designation of Wetlands of International Importance; national inventory required.	Wise use and conservation of wetlands; maintain ecological character.	National wetland policies and site-specific management plans.	Triennial reports to Ramsar Secretariat.	Encourages participation of local communities and NGOs.	COP decisions emphasize transparency and public awareness.	Ramsar Secretariat internationally; APA nationally
National ICZM Strategy (ENGIZC)	Defines coastal zone boundaries and integrated mapping of ecosystems.	Conserve natural and cultural heritage; integrate socio-economic and ecological dynamics.	Strategic options for risk prevention and adaptive planning.	Periodic evaluation and revision; sustainability indicators.	Promotes multi-level governance and partnerships.	Mandatory public debate during strategy preparation.	APA under Ministry of Environment
Portuguese Ocean Strategy 2030 (ENM 2030)	Includes coastal ecosystems in marine spatial planning and biodiversity mapping.	Combat climate change; restore ecosystems; protect biodiversity.	Action Plan with measures for ecosystem restoration and coastal management.	Monitoring and assessment framework; governance model for implementation.	Public and private sector involvement; interministerial coordination.	Extensive public consultation before approval.	DGPM

Table 9: Overview of the most wetland-relevant policy targets and objectives and their connection to EU and/or global policies.

Policy	Targets (objectives)	Link to EU or global policy
Climate change mitigation and adaptation		
Programme of Action for Adaptation to Climate Change (P-3AC) (2019)	• Ensure sedimentary replenishment, including high magnitude artificial operations and the operationalisation of processes promoting the natural restoration of sedimentary transit from river basins; • Maintain or restore natural transition zones between coastal and terrestrial ecosystems.	UNFCCC and Paris Agreement
Portaria n.º 442/2025/1 ('Floresta Azul' Program)	• Implement restoration of seagrass meadows (pradarias marinhas) as critical blue-carbon habitats. • Mandate mapping, ecological monitoring, and quantification of carbon sequestration capacity. • Integrate seagrass data into the National Emissions Inventory in line with IPCC guidance.	EU Climate Law, UNFCCC, IPCC Guidelines

Nature and biodiversity		
Sectoral Plan of Natura 2000 Network (2008)	• Protect coastal wetlands within particular sites under protection • Restore wetlands that provide habitat for protected species.	EU Birds and Habitats Directives
National Strategy for Nature Conservation and Biodiversity 2030 (ENCNB 2030) (2018)	• Promote and restore connectivity between terrestrial, aquatic (including transitional) and marine ecosystems through green infrastructure measures.	CBD, EU Biodiversity Strategy (2020)
Water, marine and coastal protection		
The Water Law (2005)	• Prevent further degradation and protect and improve the status of aquatic ecosystems and also terrestrial ecosystems and wetlands directly dependent on aquatic ecosystems	WFD
Coastal Management Programmes (POCs) (2014)	• When appropriate, increase the terrestrial buffer zone to 1000 m to protect coastal resources such as dunes, fossil cliffs, coastal lagoons and their inherent dynamics	APA, IP

Key recommendations

→ National wetland restoration targets have not been established yet, but they are planned as part of the implementation of the EU Nature Restoration Regulation. Order No. 12734/2024, of October 25th, 2024, outlines the process for preparing the National Restoration Plan, where among others coastal wetlands will be included[36].

→ Policy targets and objectives remain general, lacking specific focus on coastal wetlands. They do not include quantitative elements or clearly defined target habitats, which hinders the effectiveness of conservation efforts. With the **National Restoration Plan** under development, it is necessary to **incorporate ambitious and measurable coastal wetland restoration targets**.

→ Although there is no specific plan for restoration to date (currently under preparation), there is a set of instruments at local and regional level (Coastal Programmes (POC), Natura 2000 Network Plan, River Basin Management Plan) that establish some management measures aimed at restoring these ecosystems, although they are not mandatory.

→ The climate policy framework does not explicitly recognise wetlands, including coastal ecosystems, as nature-based solutions for climate change mitigation or adaptation. Instead, climate adaptation issues relevant to wetlands, such as flood mitigation, are primarily addressed through water, marine, and coastal policy instruments. Considering their multifunctionality, cost-effectiveness and potential for both climate change mitigation and adaptation, coastal wetland restoration needs stronger and more direct integration into national climate policies, with appropriate incentives in place for their restoration. Authorities should **explicitly include wetlands as a priority in climate policy instruments**, ensuring that **future revisions of the Basic Climate Law, adaptation strategies, and climate plans set clear, measurable targets for wetland restoration and protection**, aligned with EU taxonomy and sustainability criteria.

36 Ramsar Convention Secretariat, 2025, Ramsar National Report to COP15. Ramsar. https://www.ramsar.org/sites/default/files/2025-03/COP15NR_Portugal_e.pdf.

04

Operationalise targets and prioritise

4. Operationalise targets and prioritise

Select clear, measurable and policy-relevant indicators and metrics to track progress of coastal wetland restoration and its impact on climate mitigation

→ **Identify indicators suitable for assessing changes in the status of coastal wetlands over time and for monitoring progress toward key policy targets.**

→ **Determine approaches to operationalise policy-related metrics and indices, including methods for mapping them at different scales using spatial indicators and data layers.**

To effectively operationalise coastal wetland-relevant policy targets, it is necessary to:

- **Use clear, measurable indicators and metrics** to accurately assess the baseline of wetland ecological status and resilience. These indicators must also assess changes in the status of coastal wetlands over time and answer what is required to be monitored to track progress and measure it against national and EU policy targets for climate and biodiversity.
- **Integrate advanced technologies** like remote sensing, GIS, data analytics, and machine learning with in-situ measures which enhances the ability to monitor trends, assess interventions, and support evidence-based decisions for sustainable wetland management and restoration.

In this context, it is important to balance the need for robust indicators providing clear evidence of the contribution of coastal wetland restoration efforts to various policy objectives without creating more administrative complexity.

Portugal does not currently have a fully standardized and uniform set of national indicators specifically designed to track changes in wetland status over time and measure progress against policy targets. Monitoring remains fragmented across different frameworks and relies on sectoral instruments rather than a single integrated system. Relevant examples are:

- Habitats Directive (Article 17 reporting): Conservation status assessments for Annex I habitats (including coastal wetlands) within Natura 2000 sites, focusing on area, structure, and function but not fully aligned with NRR methodology.
- Water Framework Directive (WFD): Ecological status indicators for aquatic ecosystems, including wetlands dependent on water bodies, based on hydromorphology, water quality, and biological elements.
- Birds Directive & Biodiversity Monitoring: Wetland bird population trends used as bioindicators of habitat condition under Natura 2000 and Ramsar frameworks.
- Physical Pressure Indicators (APA REA; Agência Portuguesa do Ambiente – Relatório do Estado do Ambiente, which translates to the Portuguese Environment Agency – State of the Environment Report.): Coastal erosion and sediment dynamics tracked as part of coastal vulnerability assessments.

The Nature Restoration Regulation requires uniform condition mapping and restoration progress indicators, which Portugal is currently developing for the National Restoration Plan (due 2026–2027). To this end, indicators for wetland condition, connectivity, and ecosystem services, should be integrated into national monitoring frameworks, ensuring alignment with EU reporting obligations.

These indicators should combine ecological, hydromorphological, and biodiversity metrics to provide a comprehensive and consistent basis for tracking progress over time.

Support from RESTORE4Cs

RESTORE4Cs proposes eight policy outcome indicators to evaluate the status, trends, and targets for coastal wetlands in alignment with EU policies (Table 10). The description of each indicator also outlines how it links to existing policies such as the Habitats Directive, the WFD, and EU Nature Restoration Regulation.

The results of these indicators can be filtered and displayed for Portugal in the Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform.

The goal is to use already available data sources to provide information on these indicators, including in-situ and remote sensing data. The use of the proposed indicators should not create additional burden to competent authorities but help provide the evidence needed on the contribution of coastal wetlands restoration efforts to various policy targets.

An example of indicator application for Portugal is illustrated in Table 11, according to which about 28% of Portuga's coastal wetlands are designated as Ramsar and in Natura 2000 sites.

Table 10: Policy outcome indicators and metrics proposed by RESTORE4Cs to build evidence and foster greater integration between national and EU policies to streamline reporting processes. Indicators can be disaggregated per country and EU level.

Policy Indicator Output	Metric title	Units	Description
Extension of Coastal Wetlands Protected and Strictly Protected 	Total Coastal Wetland Extent in Protected Areas and in Strict Protected Areas	Area Coverage (km²)	Percentage change on spatial cover of total coastal wetlands protected and strictly protected from total protected areas.
	Total Coastal Wetland Extent in Natura 2000 sites	Area Coverage (km²)	Extent of coastal wetlands within the Natura 2000 network.
	Total Coastal Wetland Extent designated as Ramsar and/in Natura 2000	Area Coverage (km²)	Total area of coastal wetlands designated as Ramsar sites within the Natura 2000 network.
	Total Coastal Wetland Protected as a Proportion of Coastal Wetlands	Percentage of area coverage (km²)	Extent of coastal wetlands protected within designated areas as a percentage of the total coastal wetland extent. It offers a measure of the overall conservation coverage of coastal wetlands.
Representativity of Coastal Wetland Habitats in Protected Areas 	Spatial Cover of Different Coastal Wetland Habitats in Protected Areas	Percentage of area coverage (km²)	Coastal wetland extent data by habitat type (e.g., salt marshes, mudflats).
	Individual Coastal Wetland Habitat Extent in Natura 2000	Area Coverage (km²)	Specific coastal wetland habitat types within the Natura 2000 network.

Improved Coastal Wetland Health 	Coastal Wetland Knowledge	Proportion of data available where habitat condition is known.	Measures the extent of knowledge available regarding the habitat condition of coastal wetlands, as outlined in Annex I of the NRR.
	Coastal Wetland Habitat Condition	Percentage change in good condition of different coastal wetland habitats	Measures changes in the quality of various coastal wetland habitats (Annex I of Habitats Directive and those in Annexes I, II, IV and V of the Habitats Directive and the EU NRR) over time and per each biogeographic region. It includes factors such as vegetation health, soil quality, and water clarity.
	Coastal Wetland Biodiversity (Species) Condition	Percentage change in good condition of different coastal wetland species	Tracks changes in the condition of species diversity and abundance (referred to in Annexes II, IV and Vto Directive 92/43/EEC and of the species covered by Directive 2009/147/EC.) within different coastal wetland habitats.
	Deterioration Status	Area Coverage (km^2) of deteriorated coastal wetlands; Level of deterioration of different types; Area Coverage (km^2) of drained Coastal Wetlands and organic soils	Assesses the extension of total deterioration of coastal wetlands based on parameters such as pollution levels, Invasive species presence, drainage, and physical alterations.
	Risk Posed by Invasive Species	Area Coverage (km^2); Population size; Number of Invasive species	Assesses the size of populations and extension risk posed by invasive species (species strictly regulated + species of concern) to natural coastal wetland ecosystems.
Coastal Wetland Restoration Rate 	Hydrological Connectivity	Km of free-flowing rivers connected to coastal wetlands being restored	Evaluates changes in water flow patterns and connectivity between wetland areas
	Surface and Groundwater Restoration	Threshold values	Based on the WFD, it examines trends on water restoration efforts from multiple dimensions of surface and groundwater status, particularly quality and quantitative.
	Pollutant Reduction Effectiveness	Percentage decrease in concentrations of key pollutants	Evaluates the trend reductions in pollutant levels to meet the targets set by the Zero Pollution Action Plan, the MSFD and the WFD.
	Barrier Impact Index	% change in natural water flow patterns due to the elimination of barriers	Assesses the impact of physical barriers (e.g., roads, dams, levees, dikes, ports) on the ecological connectivity, hydrological flow (marine and coastal).
	Restoration Potential	National plans that prioritize coastal wetland restoration Area Coverage (km^2) of potential restored habitats from the proportion deteriorated	Assesses efforts to help identify and prioritise areas for coastal wetland restoration.
	Restoration Progress	Area Coverage (km^2) of habitats of coastal wetlands restored and under restoration Number of Countries Area Coverage (km^2) of coastal wetlands with restored drainage systems	Percentage change in condition or extent specifically attributable to coastal wetland areas under active restoration or restored from the percentage of area deteriorated. Habitats refers to habitat types listed in Annex I and II to the Habitats Directive and Annex II to the EU NRR.
Vulnerability to Climate-Related and Natural Disasters 	Coastal Wetland Vulnerability	Index score	Assesses the vulnerability of coastal wetlands to various environmental stressors, particularly climate change impacts such as sea-level rise, storm surge, and increased frequency of extreme weather events.

GHG Emissions and Abatement from Coastal Wetland Land Use Conversion and Restoration 	Land Use Conversion Area	Percentage Change of converted coastal wetland area	Proportion at which coastal wetlands are convertedto other land uses over time (from reference reporting period) to assess the effectiveness of land use policies to conserve natural carbon sinks such as wetlands.
	Extended Coastal Wetland Habitat Loss/Gain Ratio	Area Coverage (km²) of total coastal wetlands	Compares the area of wetland habitats lost to development or other uses against the area gained through conservation and restoration activities.
	GHG Emissions and Removals from Land Con-verted Wetlands	GHG emissions and removals /ha/year following wetland conversion	Tracks losses and emissions of CO_2, methane, and nitrous oxide resulting from the conversion of coastal wetlands to other land uses.
	GHG from Coastal Wetland Restoration	GHG emissions/ha/ year following wetland restoration	Tracks the net balance of CO2, methane, and nitrous oxide from coastal wetland restoration.
Share of Utilised Agricultural Area (UAA) under Common Agricultural Policy (CAP)– Supported Commitments in Coastal Wetlands 	Share of Agricultural Area in Coastal Wetlands	Ha of land used for agriculture within coastal wetlands. Ha of UAA within coastal wetlands that are managed under CAP-supported initiatives.	Tracks the adoption of sustainable agricultural practices and helps evaluate the impact of CAP policies on emission reduction and carbon storage.
	Agricultural Carbon Seques-tration and GHG Reduction Index in Coastal Wetlands	Carbon Sequestration Rate and GHG emissions/ ha/year from CAP Agriculture land in coastal wetlands	Tracks the adoption of agriculture lands to reduce emissions or to maintain or enhance carbon storage on agricultural land in coastal wetlands.
Overall Funding Sources for Coastal Wetlands 	Coastal Wetland Funding	Euros per reporting period	Evaluates the overall funding landscape for coastal wetlands, assesses the availability, from various sources, including government agencies, non-governmental organisations, international bodies, and private sector contribution.

Table 11: Policy indicator values in Portugal on "Extension of coastal wetlands protected and strictly protected" (December 2025).

Policy Outcome Indicator	Metric title	Units	Indicator value in Portugal
Extension of Coastal Wetlands Protected and Strictly Protected	Total coastal wetland extent under strict protection	% / km²	No data
	Total coastal wetland extent in Natura 2000 sites	% / km²	**58.26% – Area: 951.39 km²** (Reference year: 2023)
	Total coastal wetland extent designated as Ramsar and part of the Natura 2000 network	% / km²	**28.03% – Area: 457.77 km²** (Reference year: 2025)
	Total coastal wetland protected as Nationally Designated Area	% / km²	**29.86% – Area: 487.63 km²** (Reference year: 2024)

Source: Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform.

Key recommendations

→ **Complement reporting metrics for wetlands and spatial data layers** which are already used at national level with the policy outcome indicators of the Policy Progress tracking tool.

→ Include **policy outcome indicators in national strategies or actions plans** (e.g. National Restoration Plan) to monitor progress in wetland restoration.

Identify potential restoration sites for coastal wetlands

- → **Map areas of historical wetland loss resulting from past land-use conversion and infrastructure development.**
- → **Assess wetlands with the highest potential for regeneration, focusing on habitat restoration and recovery of hydrological processes.**

The systematic identification of areas suitable for wetland restoration gives the foundation for setting more specific targets for wetland restoration and optimising investment of limited resources for restoration within a country.

Conceptually, considering the policy context provided by the EU Nature Restoration Regulation, Habitats Directive, the National Strategy for Nature Conservation and Biodiversity 2030 (ENCNB 2030), and Portaria n.º 442/2025/1 ('Floresta Azul' Program), the selection of potential areas for wetland restoration should consider restoring degraded ecosystems, enhancing connectivity, and integrating blue-carbon habitats into climate change mitigation strategies. Namely, restoration should prioritize wetlands currently in poor ecological condition, as identified under Natura 2000 and national protected areas. These include estuarine margins, saltmarsh edges, and lagoon peripheries where hydromorphological stress, pollution, and fragmentation are evident. Former floodplains and reclaimed marshlands along major estuaries and lagoons also represent main candidates for ecological restoration. In addition, coastal-terrestrial ecotones, such as dune systems and low-lying buffer zones, can be restored to improve connectivity and resilience against climate impacts, aligning with the Nature Restoration Regulation and EU Biodiversity Strategy.

Support from RESTORE4Cs

The approach for locating and prioritizing potentially restorable wetlands in Portugal is based on work of the RESTORE4Cs project, considering historical wetland distribution, current land cover and land use and ecological and policy alignment, ensuring restoration efforts deliver ecological, climate, and policy benefits.

Historical Wetland Distribution - Mapping historical wetland footprints helps identify areas where wetlands have been lost due to land conversion, such as agriculture or urbanization. These zones often retain hydrological potential, making them prime candidates for rewetting and ecological recovery.

Current Land Cover and Land Use - Analysis of present-day land cover and land use determines feasibility and cost-effectiveness of restoration. Areas with low-intensity land use or abandoned agricultural plots are prioritized for conversion back to wetland habitats.

Ecological Benefits and Policy Alignment - Restoration prioritization considers biodiversity gains, hydrological connectivity, and climate change mitigation potential (blue carbon). This ensures alignment with EU Nature Restoration Regulation, Habitats Directive, and national strategies such as ENCNB 2030 and Portaria n.º 442/2025/1.

In addition, the RESTORE4Cs approach uses spatial modeling and ecological scoring to rank sites based on restoration potential. Criteria include ecosystem services, resilience to climate change, and contribution to Natura 2000 and Ramsar objectives.

The identification and prioritization of wetland restoration opportunities in Portugal are central to meeting national and EU policy targets, including the EU Nature Restoration Regulation, the Habitats Directive, and the National Restoration Plan. The following maps (Figure 7 and Figure 8), developed under the RESTORE4Cs project, provide a spatially explicit basis for restoration planning by illustrating (1) the distribution and probability of potential wetland areas (PWA) across mainland Portugal, and (2) the location and degree of potentially restorable wetlands (PRW), integrating historical wetland footprints, current land use, and ecological suitability. Together, these maps support evidence-based decision-making for ecosystem restoration, climate change mitigation, and biodiversity conservation.

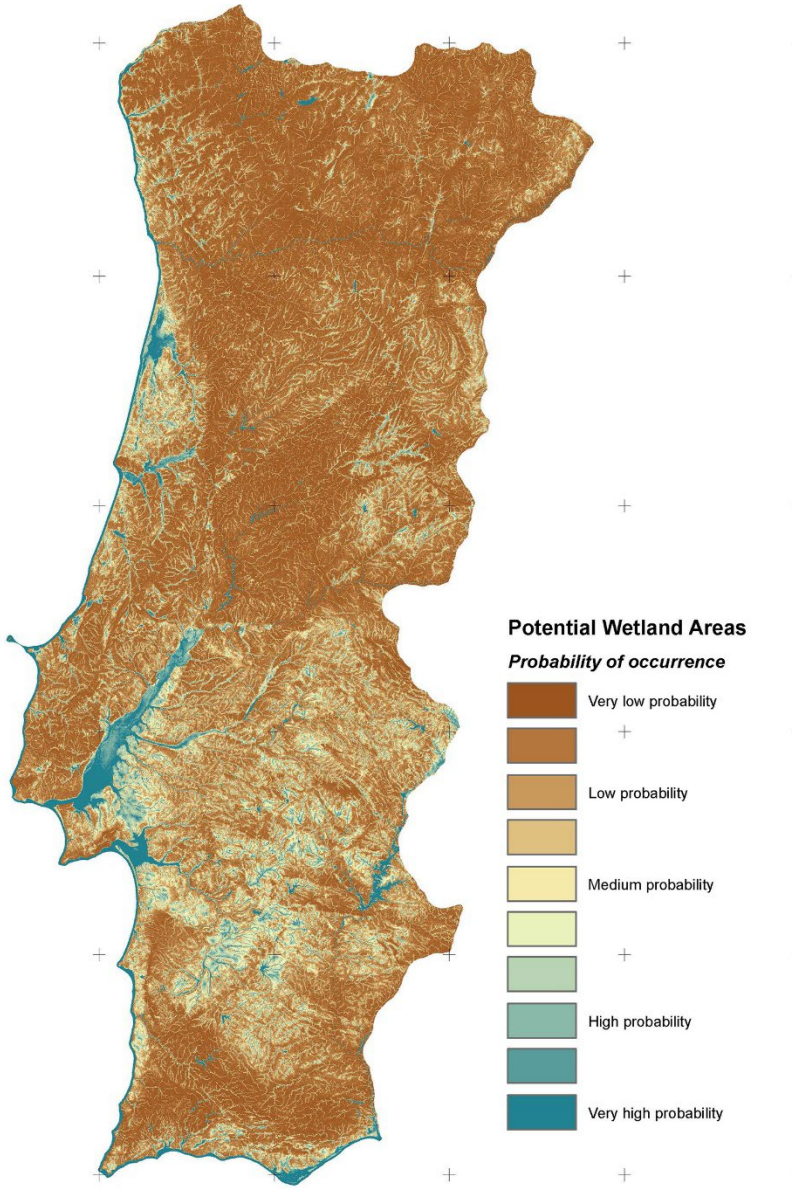


Figure 7: Probability of Potential Wetland Areas (PWA) Across Mainland Portugal. Source: Spatial Decision-Support Toolbox on the RESTORE4Cs European Coastal Wetlands Interactive Platform.

The map on Figure 7 displays the spatial probability of wetland occurrence throughout mainland Portugal, ranging from very low to very high probability. Areas with higher probability (depicted in darker shades) are concentrated along major river valleys, estuaries, and low-lying coastal zones, reflecting regions with favorable hydrological and geomorphological conditions for wetland formation. The Tagus, Sado, and Mondego estuaries, as well as the Ria de Aveiro and Ria Formosa lagoon systems, stand out as key wetland-rich regions. Inland, the map highlights floodplains and

riparian corridors with moderate to high wetland potential. This spatial layer serves as a baseline for identifying both existing and lost wetlands, guiding restoration efforts toward areas with the greatest ecological feasibility and alignment with historical wetland distribution.

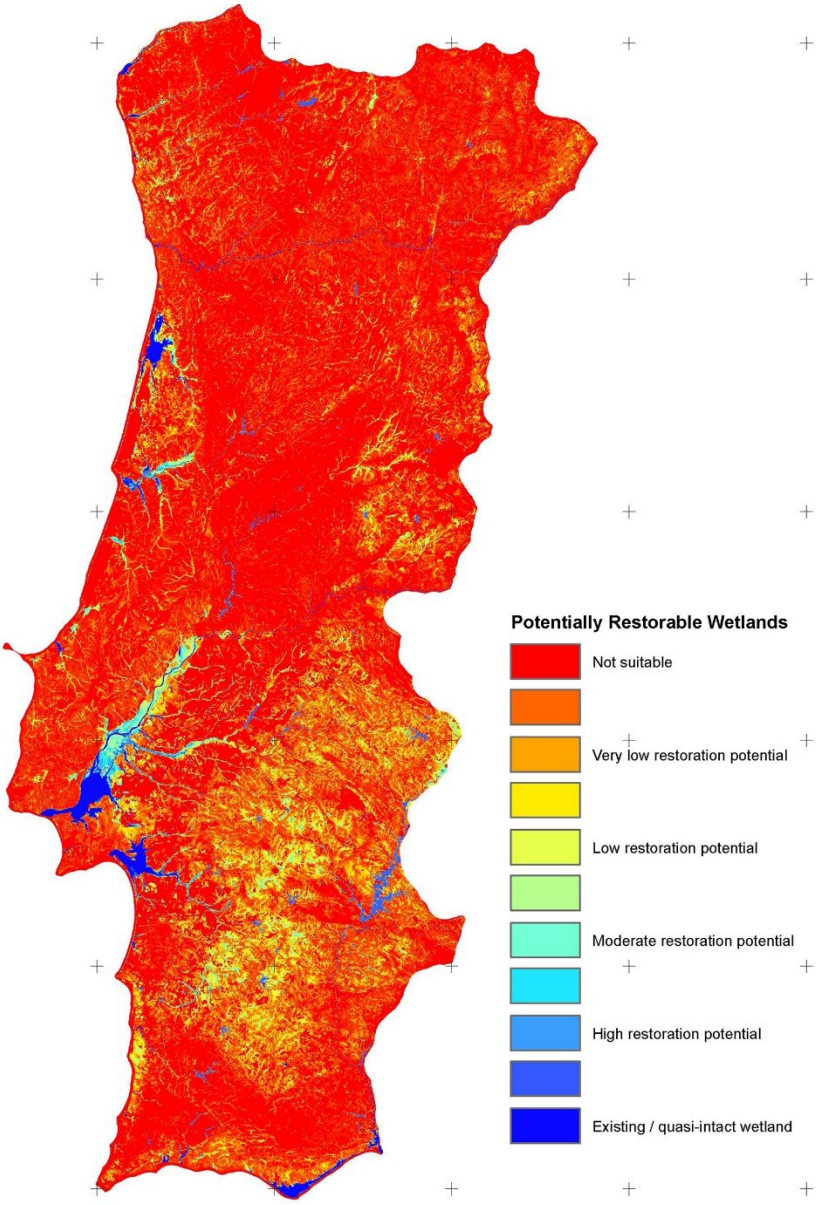


Figure 8: Potentially Restorable Wetlands (PRW) and Restoration Suitability in Mainland Portugal. Source: Spatial Decision-Support Toolbox on the RESTORE4Cs European Coastal Wetlands Interactive Platform.

The map on Figure 8 refines the restoration focus by classifying the landscape according to restoration suitability, from 'not suitable' to 'high restoration potential,' and marking existing or quasi-intact wetlands. High and moderate restoration potential areas (shown in yellow to green) are primarily located in former wetland zones that have been altered by agriculture, drainage, or land conversion but retain hydrological connectivity. These include the peripheries of major estuaries, coastal lagoons, and floodplains, as well as certain lowland agricultural regions. The map also delineates areas where restoration is less feasible due to irreversible land use change or lack of hydrological potential. By overlaying existing wetlands, the map helps prioritize restoration in degraded zones adjacent to intact habitats, maximizing ecological connectivity and resilience. This approach supports the strategic targeting of restoration investments to achieve national and EU restoration objectives.

Key recommendations

→ Use the systematic mapping of Potential Wetland Areas (PWA) and Potentially Restorable Wetlands (PRW) to **define quantitative, location-specific restoration targets in the National Restoration Plan**, in line with the EU Nature Restoration Regulation and ENCNB 2030. This approach enables to prioritize restoration in areas with high ecological feasibility, such as degraded estuarine margins, saltmarsh edges, lagoon peripheries, and historical floodplains, where restoration can deliver the greatest biodiversity, connectivity, and climate change mitigation benefits.

→ Ensure restoration planning is aligned with Natura 2000, Ramsar, and national protected area objectives, **maximizing synergies with existing conservation frameworks, namely by adopting the RESTORE4Cs multi-criteria approach**, combining historical wetland distribution, current land use, ecological scoring, and policy alignment, to rank and select restoration sites.

→ **Promote restoration of blue-carbon habitats (saltmarshes, seagrass beds)** as mandated by Portaria n.º 442/2025/1, integrating these efforts into national climate change mitigation and reporting strategies, but also restoration in coastal-terrestrial ecotones (e.g., dune systems, buffer zones) and areas adjacent to existing wetlands to enhance landscape connectivity and resilience to climate change.

05

Plan restoration activities

5. Plan restoration activities

Scope suitable restoration techniques to increase GHG mitigation capacity of coastal wetlands

→ **Identify types of restoration actions in coastal wetlands which increase the C-sequestration and reduce GHG emissions by lowering the pressure level and reducing the impacts.**

Selecting suitable restoration techniques defines the effectiveness of restoration actions in delivering numerous ecosystem services, e.g., improving biodiversity state, enhancing climate change mitigation capacity, reducing disaster risks. The selection of a specific type of restoration actions depends on site-specific conditions, including hydrology, soil, flora, and fauna as well as existing anthropogenic treats. A scientific assessment of these factors and impacts different restoration measures have on them allows prioritising restoration methods and tools informing restoration decisions. This helps maximise the benefits of wetland restoration to support the achievement of policy targets and objectives.

Considering the national reference documents on blue carbon - Roadmap for a voluntary market in Portugal[37], Scientific Report I: Assessment of blue carbon ecosystems in mainland Portugal[38], Scientific Report II: Assessment of blue carbon ecosystems in mainland Portugal[39] restoration actions in coastal wetlands that increase C-sequestration and reduce GHG emissions include hydrological restoration, water quality improvement, invasive species control, active and passive vegetation restoration, sediment management, and adaptive monitoring. For salt marshes and seagrasses, these actions are particularly impactful, turning degraded or artificialized areas into effective blue carbon sinks and supporting Portugal's climate and biodiversity goals. In more detail, the actions include re-establishing natural tidal flow, and hydrodynamics is fundamental for both salt marshes and seagrasses; restoring or reconnecting former salt marsh or seagrass areas that were converted for agriculture, aquaculture, or salt production; reopening or reconfiguring channels to improve water circulation and sediment transport, reducing nutrient and organic pollution (e.g., from agriculture, urban runoff, aquaculture) is critical, especially for seagrass meadows, which are highly sensitive to eutrophication; implementing buffer zones and sustainable agricultural practices to reduce fertilizer and pesticide runoff; controlling or eradicating invasive plants and animals (e.g., *Spartina patens* in salt marshes, invasive polychaetes in seagrass beds) that alter ecosystem structure and function; transplanting or seeding native seagrasses (e.g., *Zostera noltei, Zostera marina*) and salt marsh plants (e.g., *Sarcocornia, Salicornia, Atriplex portulacoides*) in degraded or artificialized areas; using healthy meadows or nurseries as donor sites and protecting young plants from physical disturbance; identifying and targeting inactive salt pans, aquaculture ponds, or reclaimed agricultural land for passive or active restoration; allow natural recolonization or assisting with planting; and managing dredging and sediment placement to avoid damaging existing habitats and to use dredged material for beneficial restoration (e.g., raising marsh elevation to counteract sea level rise). Following the same reports, restoration actions in coastal wetlands, particularly in salt marshes and seagrass meadows, have a profound impact on carbon sequestration and greenhouse gas mitigation by addressing key ecological processes and pressures. By re-establishing natural tidal regimes and sediment deposition, these interventions reduce the

37 https://gulbenkian.pt/en/publications/carbono-azul-roteiro-para-um-mercado-voluntario-em-portugal/.
38 https://cdn.gulbenkian.pt/wp-content/uploads/2024/06/FCG_BlueCarbon_Report-I.pdf.
39 https://cdn.gulbenkian.pt/wp-content/uploads/2024/06/FCG_BueCarbon_Report-II.pdf.

oxidation of organic matter in sediments, which would otherwise result in the emission of CO_2 and N_2O, and enable the natural recolonization of native vegetation. This process increases the accumulation and long-term storage of organic carbon in both biomass and sediments. Improvements in water quality, achieved by reducing nutrient and organic pollution, prevent algal blooms and hypoxia, support the healthy growth of salt marsh and seagrass communities, and maintain high rates of carbon sequestration while minimizing methane (CH_4) and nitrous oxide (N_2O) emissions. The restoration of native community structure, through the removal of invasive species and the reintroduction of characteristic halophytes and seagrasses, enhances sediment stability and the efficiency of carbon burial. Active and passive restoration actions accelerate the recovery of primary production and sediment accretion, increasing the input of organic carbon to sediments and enhancing the ecosystem's capacity for long-term carbon storage. Furthermore, converting previously degraded or artificialized areas, such as abandoned salt pans or aquaculture ponds, into restored blue carbon ecosystems transforms former sources of greenhouse gas emissions into carbon sinks, expands the area available for blue carbon sequestration, and restores essential ecosystem services. These measures maintain or enhance the resilience of marshes and seagrass beds, prevent the loss of stored carbon, and support the continued sequestration of greenhouse gases, thereby contributing to climate change mitigation and the sustainability of coastal ecosystems.

Support from RESTORE4Cs

Advancing Quantification of GHG Emissions in Coastal Wetlands

The RESTORE4Cs project represents a major advance in understanding the climate mitigation potential of coastal wetland restoration by providing direct, quantitative measurements of greenhouse gas (GHG) fluxes alongside carbon sequestration indicators[40]. Previous reports often lacked empirical data on CO_2, CH_4, and N_2O emissions, limiting the ability to assess net climate benefits. RESTORE4Cs addresses this gap through multi-season, multi-site monitoring across diverse European wetlands, including salt marshes and seagrass meadows. Using standardized static chamber techniques, the project quantified CO_2 uptake and CH_4 emissions under preserved, altered, and restored conditions, enabling robust comparisons of restoration outcomes. Results confirm that restoration generally enhances carbon storage without causing systematic increases in methane or nitrous oxide emissions, supporting the role of restored wetlands as net carbon sinks. By integrating empirical flux data with ecosystem drivers such as hydrology, salinity, and vegetation cover, RESTORE4Cs delivers policy-ready evidence for incorporating coastal wetland restoration into climate mitigation strategies and carbon accounting frameworks.

Summary of RESTORE4Cs findings for Ria de Aveiro

In Ria de Aveiro, the national case pilot, RESTORE4Cs quantified seasonal GHG fluxes in restored, well preserved (reference seagrass meadows) and impacted, providing one of the first datasets for this ecosystem in Portugal. Measurements showed that restored seagrass beds exhibit increased sediment carbon accumulation and stable or reduced CH_4 and N_2O emissions compared to degraded sites. CO_2 uptake through photosynthesis was substantial, reinforcing the role of seagrass restoration for climate mitigation. These findings confirm that restoration not only enhances biodiversity and sediment

40 Cabrera-Brufau, M. et al, Assessing the effects of restoration and conservation status on gaseous carbon fluxes and climate mitigation capacity across six European coastal wetlands (preprint) https://doi.org/10.31223/X5PB36.

stability but also delivers measurable climate benefits, supporting its integration into blue carbon strategies and national restoration targets.

Key recommendations

- → Restoration actions in coastal wetlands, especially salt marshes and seagrass meadows, are most effective when tailored to local conditions and implemented as part of an integrated, adaptive approach.
- → Empirical evidence from RESTORE4Cs demonstrates that coastal wetlands restoration can deliver significant climate mitigation benefits without increasing GHG emissions, supporting their prioritization in policy and management for blue carbon and ecosystem service delivery in Portugal.
- → The selection of restoration techniques should be site-specific and supported by science-based data, to maximize carbon sequestration and GHG mitigation, and ensure sustained climate and ecosystem benefits.
- → Coastal wetland restoration should be framed in national climate and biodiversity strategies, aligning with international commitments.

Assess the benefits and costs of coastal wetland restoration actions for climate change mitigation

- → **Identify the most cost-effective restoration actions for coastal wetlands based on available evidence and resource constraints.**
- → **Evaluate the performance of different restoration options across multiple dimensions, including social, environmental, and economic benefits.**
- → **Assess the level of social acceptability of various restoration actions within the relevant local and regional contexts.**

Restoring coastal wetlands is a multidimensional planning challenge involving trade-offs between ecological, social, and economic priorities. Restoration actions can yield substantial benefits, such as carbon sequestration, biodiversity recovery, and flood regulation. However, they also come with costs, namely financial, social, and sometimes political. To be successful, restoration planning must evaluate both the cost-effectiveness of interventions and their social acceptability. The latter is necessary to reflect the local needs and values, ensure support at the level where implementation and maintenance efforts take place. Restoration scenarios that ignore local preferences or undervalue societal co-benefits risk resistance, failure, or unintended harm. For this reason, transparent, evidence-based evaluation of benefits, costs, and stakeholder values is essential to ensure long-term impact, sustainability and legitimacy of restoration actions.

In Portugal, the main risks to coastal zones are associated with erosion and coastal retreat. This process, driven by human activities that alter coastal dynamics, poses a significant challenge for coastal planning and management. It underscores the need to reduce impacts, e.g., through protective measures or by addressing the loss of natural areas, along with the associated social and economic consequences [41]. For this reason, assessing costs and benefits of coastal wetland restoration as one of possible responses to these challenges presents an important task in the Portuguese context.

Support from RESTORE4Cs

RESTORE4Cs applied a participatory **Multi-Criteria Analysis (MCA)** framework to assess stakeholders' preferences for multiple restoration options in six case pilot sites, including Ria de Aveiro, for coastal wetland restoration, integrating ecological, socio-economic, and socio-cultural indicators.

The MCA framework is highly applicable to wetlands restoration decision-making as a multidimensional analysis tool which integrates social perception of criteria importance. It is suitable for the evaluation and comparison of alternatives based on more than one criterion or objective which are difficult to quantify or express in monetary terms. In comparison, other economic evaluation tools like cost-effectiveness analysis and cost-benefit analysis tend to be applicable for monetized or single variables, while by definition wetlands restoration requires to consider a set of different factors.

41 Maia, A., Bernardes, C., & Alves, M. (2014). Cost-benefit analysis of coastal defenses on the Vagueira and Labrego beaches in North West Portugal. Revista De Gestão Costeira Integrada, 81–90. https://doi.org/10.5894/rgci521.

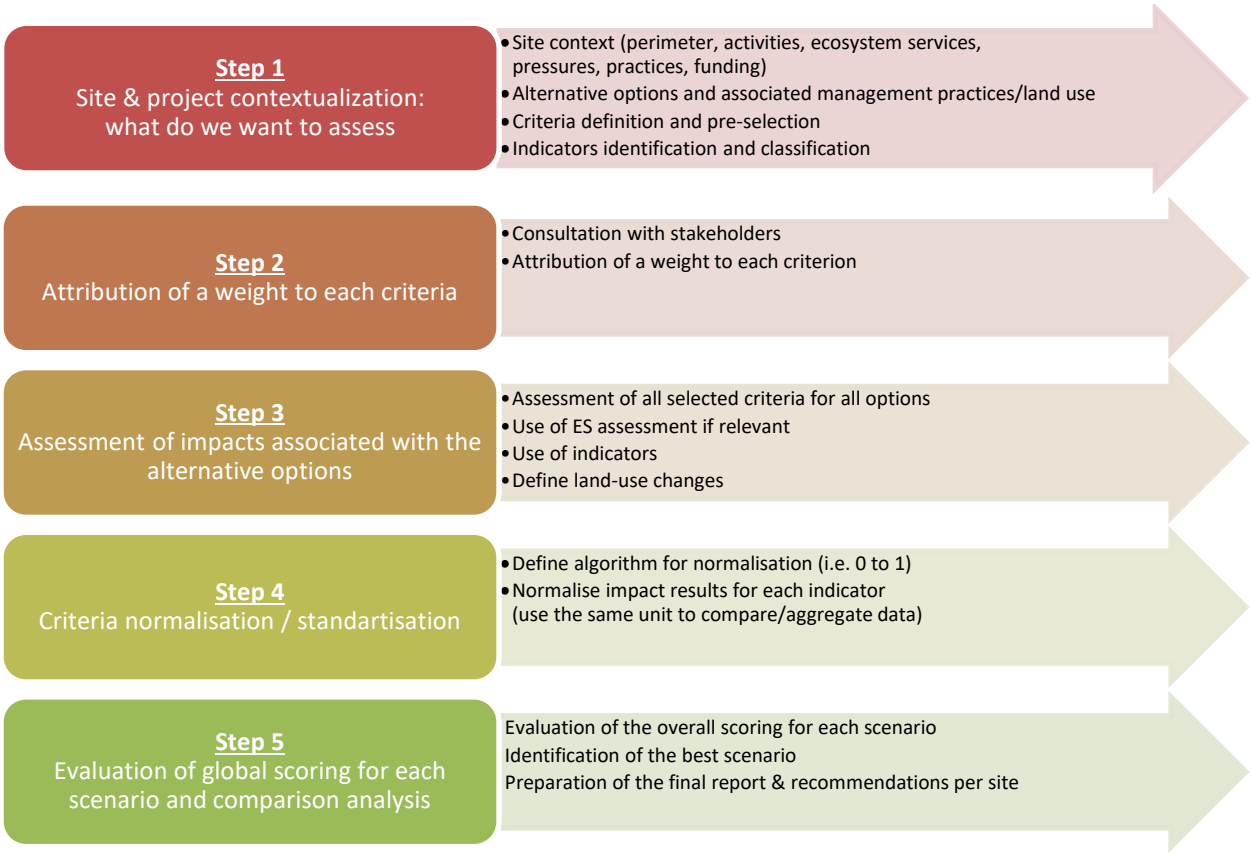


Figure 9: MCA Methodology steps applied to RESTORE4Cs sites. Source: Anglada et al. 2025.

Following the methodological steps for conducting an MCA of coastal wetland restoration in the RESTORE4Cs sites (Figure 9), costs and benefits of restoring sites in Ria de Aveiro were assessed.

As part of Step 1, two options or scenarios were defined:

1. **Soft solution (Business as Usual)**, characterised by natural evolution of saltmarshes to more subtidal mudflats;
2. **Low technology restoration solution**, defined by mitigation of the habitat loss of saltmarshes by planting seagrasses that are well adapted to intertidal and subtidal conditions and have the same ecological function.
3. **High technology restoration solution**, described as a loss reduction by enhancing accretion, which will elevate the vegetated mudflat and keep the intertidal conditions, potentially implicating the transplanting of saltmarshes plants.

In Step 2 and 3, two workshops[42] took place with 29 local stakeholders[43] to rate criteria, selected by project partners based on the concerns and proposals shared by the local stakeholders. In total, 21 workshop participant rated criteria across **socio-economical** (agriculture/breeding/apiculture, fishing, tourism/recreational activities, jobs created or lost during restoration, investment costs, maintenance costs, flood control / drainage, protecting the banks of the Ria), **environmental** (aquatic habitats

42 RESTORE4Cs Guidance for Step 2 of the MCA – Workshop can be accessed in Annex 7.3 of the Report on cost/benefit analysis of wetland restoration options and on financing tools. Available at: https://www.restore4cs.eu/about/workplan/ (WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

43 A non-exhaustive list of the stakeholders involved: Portuguese Environmental Agency, Institute for Nature Conservation and Forests, Regional Coordination and Development Commission, Aveiro Reion Intermunicipal Community, landowners.

created/preserved or lost, land habitat lost, species richness, global climate regulation, soil quality improvement, water quality improvement), and **socio-cultural** (cultural heritage, place attachment, physical and mental health, education and recreative interest, participation in decision making) themes. For each criterion, an associated indicator was selected to assess the intensity of importance of the criterion in decision-making.

As a result of a weighing exercise, the categories considered in priority by local stakeholders when implementing a restoration project are '**Biodiversity'** (species richness, invasive alien species introduced) and '**Habitats'** (aquatic habitats created/preserved or lost, land habitat lost) categories (see Table 12). The **'Water cycle'** (water quality improvement) is considered in third priority as well as the criterion 'Cost of restoration', equally driven by 'Investment costs' and 'Maintenance costs'.

Table 12: The weight that criteria should have when considering a restoration project, according to Ria de Aveiro´s stakeholders (21 respondents).

Level 1 (Themes)	Weight	Level 2 (Categories)	Weight	Level 3 (Criteria)	Weight
Socio-economics	**29%**	Socio-economics activities	**6%**	Agriculture, breeding, apiculture	**12%**
				Fishing	**30%**
				Tourism / Recreational activities	**21%**
				Harbour activities	**24%**
				Salt production	**14%**
		Employment	**6%**	Jobs created or lost during restoration	
		Costs of the restoration project	**9%**	Investment costs	**45%**
				Maintenance costs	**55%**
		Costs of the restoration project	**8%**	Flood control / drainage	**52%**
				Protecting the banks of the Ria	**48%**
Environment	**47%**	Habitats	**11%**	Aquatic habitats created/preserved or lost	**52%**
				Land habitats lost	**48%**
		Biodiversity	**13%**	Species richness	**64%**
				Invasive alien species introduced	**36%**
		Climate	**8%**	Global climate regulation	
		Soil	**6%**	Soil quality improvement	
		Water cycle	**9%**	Water quality improvement	
Socio-cultural	**24%**	Cultural landscape and land uses	**5%**	Cultural heritage	
		Values and beliefs	**0**	Place attachment	
		Health and well-being	**6%**	Physical and mental health	
		Local awareness and knowledge	**6%**	Education & recreative interest	
		Institution and governance	**4%**	Participation in decision-making	
				Cultural heritage	

In Steps 4 and 5, using the 'Min-Max' normalisation method, all scenarios were assessed, with **the scenario** '**Low technology restoration solution**' **obtaining a significantly higher value**, making it the **best alternative** for the Ria de Aveiro context. This means that this scenario makes a positive contribution to a greater number of indicators than the other scenarios. Further analysis with the 'Max' normalisation method also confirms **this scenario to be the best alternative**, despite integrating the highest maintenance costs.

Finally, the Vector normalisation method identifies the low-technology restoration option as the most favourable among those assessed and indicates that the reduction in global warming potential from now to 2050 is expected to be more substantial than the changes observed in any other impact indicator in this scenario.

The MCA results suggest that restoring salt marshes using low-technology methods, such as planting seagrasses adapted to intertidal and subtidal zones with similar ecological functions, could help achieve a balanced situation in the Ria de Aveiro by 2050. High-technology restoration methods, like enhancing sediment accretion to reduce marsh loss, appear to deliver the greatest reduction in global warming potential and therefore strengthen climate resilience. If reducing global warming potential is a priority, combining elements of these two options could be a valuable approach.

Risks and uncertainty associated with this assessment:

- Not all socio-economic interests were represented, which may introduce a bias toward environmental criteria;
- This model, though providing additional elements to keep in mind, cannot be used to predict an exact tipping point at which a scenario will cease to be the best alternative, simply based on costs.

Replicability to other coastal wetland habitats in Portugal

The methodology used to assess costs and benefits of restoration in the Ria de Aveiro can be applied to other coastal wetlands in Portugal.

- The indicator list specifically developed for the MCA in the Ria de Aveiro context can serve as a starting point and be adapted to the specific characteristics of other coastal wetland types.
- The preliminary selection of stakeholders (e.g., Portuguese Environmental Agency, intermunicipal community, landowners), procedures for gathering stakeholder insights and preferences, such as surveys, interviews, workshops, presented in Anglada et al. (2025)[44] can be applied to other Portuguese sites.
- The overall step-by-step approach to implementing the MCA is easily replicable to other locations.
- Specific MCA results, such as the importance of accounting for maintenance costs as part of a restoration project, align with the general trends identified across the various sites, indicating that these findings may also be relevant for other Portuguese locations.

44 Anglada, C. et al. (2025). Report on cost/benefit analysis of wetland restoration options and on financing tools. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Key recommendations

- → **Multi-Criteria Analysis (MCA)** is recommended **to assess coastal wetland restoration options** in Portugal beyond just cost or climate benefits, including social and ecological aspects. In doing so, it is necessary to engage stakeholders early to reflect local values, capture their preferences and ensure for the social acceptance of restoration plans. A pre-analysis of the socio-cultural and socio-economic background is important to prepare the ground in the most efficient way.
- → Consider **combining elements from different scenarios** to maximise socio-economic benefits while strengthening environmental protection, including climate regulation.
- → Ensure **balanced stakeholder representation in the MCA** to cover all types of interests evenly. Use the stakeholder categories identified for the Ria de Aveiro MCA as a reference point when selecting stakeholders for MCA application in other locations. Promote strong stakeholder participation and ensure the weighting exercise is completed accurately by all stakeholders.
- → Use the indicator list developed for the MCA in the Ria de Aveiro context as a starting point for **conducting the assessment of costs and benefits in other coastal wetland types**, adjusting it to the local specifics.

Identify funding sources

- → **Identify viable funding mechanisms to cover the costs of restoration.**
- → **Determine the most accessible and appropriate funding sources for restoration activities.**
- → **Align long-term restoration and maintenance financing needs with suitable public and private financial instruments.**
- → **Strengthen the role of national authorities in establishing enabling frameworks for public–private partnerships (PPPs) in wetland restoration.**

Securing adequate and sustainable funding is one of the most pressing challenges in coastal wetland restoration. While public funds (especially from EU programmes) remain essential, they are often specific for the restoration itself, project-based, sector-oriented or not taking into account long-term ongoing and recurring operational cost. The current models also rarely link funding to ecological performance or long-term ecosystem service delivery, limiting incentives for adaptive management. Recurring costs, such as monitoring, hydrological regulation, adaptive management, education and outreach activities, often remain underfunded[45]. Identifying and mobilising diverse public and private funding sources, including climate finance, biodiversity-focused instruments, and private sector contributions, is key to scaling and long-term sustaining restoration efforts. A proactive financing strategy ensures that restoration is not only technically, socially and economically viable but also financially feasible and resilient to policy shifts.

In Portugal, funding for wetland conservation and restoration primarily comes from public sources, i.e. the government´s Environmental Fund or the EU funding mechanisms, while the information about private financing is limited. When the private sector is involved, efforts tend to focus on forest ecosystems (e.g., Nature Returns model[46], national voluntary carbon market[47]). Although some private companies have shown interest in offsetting part of their GHG emissions through blue carbon projects as well[48], no market for outcomes of such projects exists in Portugal yet. Therefore, it is important to channel emerging private interest in nature restoration toward projects dealing with coastal wetlands and to create strong incentives for their participation. Establishing public-private partnerships (PPP) is one of the ways to distribute risks, leverage commentary strengths and ensure long-term maintenance funding. However, to be effective, PPPs require transparency, clear benefit-sharing models, and alignment with both climate and socio-economic objectives.

45 Anglada, C. et al. (2025). Report on cost/benefit analysis of wetland restoration options and on financing tools. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

46 Ascenzi, G., Grace, E., Bhattacharjee, A., Silva, L.N., and Cassola, R. (2025). Restoration Project Developers' Playbook on Private Finance (Europe). UN Environment Programme World Conservation Monitoring Centre. Cambridge UK https://doi.org/10.34892/rma6-d142.

47 Republica Portuguesa, 2025. Government signals the start of the Voluntary Carbon Market. Available at: https://www.portugal.gov.pt/en/gc25/communication/news-item?i=governo-signals-the-start-of-the-voluntary-carbon-market.

48 De Oliveira, R. X. 2023. Blue Carbon: A Roadmap for a Voluntary Market in Portugal. Elaborated by ANP|WWF as part of the Gulbenkian Blue Carbon project. Available at: https://cdn.gulbenkian.pt/wp-content/uploads/2024/06/FCG_EN_BlueCarbon_Roadmap.pdf.

To identify funding sources suitable for coastal wetland conservation in a specific site, the following steps are proposed:

1. **Collect financial and contextual information** from the areas where restoration is to take place. Determine geographic location, relevant stakeholders, designation status, wetland type, the scale and restoration objectives which will support in matching the right funding source. Identify ecosystem service benefits, informed by stakeholder and expert assessments. Identify potential funding sources (e.g., blended finance or Payment for ecosystem services (PES)) and instruments already used, as well as possible revenue streams and ultimately financial gaps.
2. **Compile an inventory of public and private financing opportunities** in the respective country, region or municipality. Use existing literature, expert interviews, and financing inventories, for example, those developed as part of the RESTORE4Cs project[49].
3. **Match the site needs with appropriate funding tools and their requirements.** Ensure eligibility and the alignment of funder´s priorities with restoration objectives.

Support from RESTORE4Cs

Tools for preparation of a financial plan

A dedicated Excel template was designed to ensure the systematic collection and organisation of financial and contextual information regarding a specific restoration site. The template guides experts in documenting key aspects of their restoration projects under consistent headings:

1. **Case pilot context** (geographic location, designation status, and wetland type);
2. **Past and future restoration actions and challenges**, detailing environmental pressures and intervention strategies;
3. **Benefits of restoration**, covering ecosystem service benefits, observed or anticipated, informed by stakeholder and expert assessments;
4. **Financial costs of restoration**, distinguishing one-off capital expenditures from ongoing operational costs;
5. **Financing mechanisms**, including funding sources and instruments used;
6. **Revenue and funding gaps**, highlighting the limitations in sustaining restoration outcomes over time, particularly regarding maintenance and monitoring;
7. **Conclusion and Potential Financing Solutions**, proposing strategies to strengthen long-term financing.

The information collected in such systematic manner can be used to prepare a financing plan for specific restoration sites in Portugal reflecting both on the current situation, i.e. past or existing plans for restoring coastal wetlands, and the future situation, covering restoration plans that have not yet been implemented.

49 Anglada, C. et al. (2025). Report on cost/benefit analysis of wetland restoration options and on financing tools. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Trends and their relevance for Portugal

As result of the RESTORE4Cs cross-site analysis, two major trends, likely to be observed in Portugal as well, were identified:

1. One-off capital costs for restoration (e.g., landscape design, hydrological infrastructure, habitat restoration and re-profiling) are generally well-covered through public sector or EU structural funding. However, **gaps often persist for ongoing operational costs**, particularly those involving:

- **monitoring and maintenance** (e.g., hydrological regulation, habitat upkeep). Maintenance costs, perceived as important factor by Portugal´s national and local stakeholders[50], are especially high in remote restoration areas, like, for example, in Ria de Aveiro;
- **adaptive management** (e.g., response to invasive species, sedimentation shifts). For example, in Rio de Aveiro, 11 exotic invasive plant species were identified in 2022, with local stakeholders highlighting this topic as a critical to consider in a restoration project;
- **community engagement and education initiatives**. Portugal´s national and local stakeholders recognise the necessity of awareness raising and knowledge increasing activities, although placing more importance on socio-economic and environmental aspects in the Ria de Aveiro context.

The absence of secure, long-term financing mechanisms places restoration outcomes at risk, especially in the areas where political or funding priorities tend to shift over time.

2. Market-based or investment-driven private finance, such as biodiversity offsets, PES schemes, or eco-tourism partnerships with local SMEs, **are rarely observed** in coastal wetland restoration projects, despite having high potential, when properly framed. Currently, existing PES schemes in Portugal are publicly funded, i.e. the government's Environmental Fund remunerates landowners and managers to restore and protect biodiversity and ecosystem services in protected areas, focusing on forest ecosystems[51].

Solutions: diversifying financing for coastal wetland restoration

To overcome these limitations, there is a need to develop intermediary structures and governance models that can de-risk private involvement, translate ecological benefits into investable outcomes, and build trust between public, civil society, and private actors. Instruments such as **green bonds, environmental impact funds, biodiversity credits, or CSR-linked partnerships** with sectors like tourism, water utilities, or infrastructure could offer viable entry points, especially when tied to measurable ecosystem outcomes. Future restoration initiatives should proactively design for private sector engagement from the outset, enabling **private-public partnerships** (PPP), whether through co-funding opportunities, tax incentives, or benefit-sharing mechanisms that link business interests to ecosystem health. Doing so could significantly enhance the financial sustainability and policy relevance of wetland restoration across Europe.

50 Stakeholders in question were part of the RESTORE4Cs MCA exercise. Among them, the representatives of the following organisations/stakeholder groups were included: Portuguese Environmental Agency, Institute for Nature Conservation and Forests, Regional Coordination and Development Commission; Aveiro Region Intermunicipal Community; landowners. Source: Anglada et al. 2025.

51 IEEP (2023) Exploring policy options for funding nature restoration in the next MFF: report of a workshop discussion. Institute for European Environmental Policy, Brussels.

Table 13 summarises the most promising options for private financing of coastal wetland restoration, applicable in the Portuguese context.

Table 13: The most promising opportunities for private financing of coastal wetland restoration in the Portuguese context.

Instruments	Description	Relevance for Portugal´s coastal wetland restoration
Revolving funds, conservation endowments	Long-term financial mechanisms designed to ensure continuity in restoration financing, can cover maintenance costs and adaptive management. Revolving funds support repeated investment cycles through reinvested repayments, while endowments generate perpetual funding from investment returns. **These instruments create enabling environment for public-private partnerships.**	These instruments are generally applicable and can be tailored to Portugal's priority coastal wetlands. Given the high importance placed on covering maintenance costs by national and local stakeholders[52], these instruments are expected to be socially acceptable within the Portuguese context.
PES (e.g., biodiversity offset markets, blue carbon markets)	Financing is raised by selling the 'rights' to ecosystem services generated by the NbS. These instruments help internalise the environmental benefits generated by wetlands, such as carbon storage, water purification, and habitat provision, into tangible financial cash flows or revenues. **These instruments create enabling environment for public-private partnerships.**	These tools, particularly those linked to biodiversity-positive outcomes, may be especially relevant for Portuguese coastal wetlands, where species richness is identified as one of the main priorities in restoration projects, like in Ria de Aveiro area. Establishing a voluntary blue carbon market is another promising opportunity that can be realised in Portugal, learning from good practice examples in France (Low Carbon Label) and Spain (Andalusian carbon offsetting mechanism) (e.g., see the Roadmap for a voluntary market in Portugal by the Gulbenkian Blue Carbon project[53]).
Community and local business engagement	This instrument can both generate revenue and enhance public stewardship especially in promoting eco-tourism, nature-based education, and low-impact economic activities.	In the areas, where tourism and recreational activities are considered of medium importance, like in Ria de Aveiro, they can be combined with other more socially acceptable activities, e.g., sustainable recreational fishing can be seen as one of the promising and socially acceptable activities that could generate additional income for the restoration site.

52 Anglada, C. et al. (2025). Report on cost/benefit analysis of wetland restoration options and on financing tools. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

53 De Oliveira, R. X. (2023). Blue Carbon: A Roadmap for a Voluntary Market in Portugal. Elaborated by ANP|WWF as part of the Gulbenkian Blue Carbon project. Available at: https://cdn.gulbenkian.pt/wp-content/uploads/2024/06/FCG_EN_BlueCarbon_Roadmap.pdf.

Supporting public-private partnerships using MCA

MCA results provide insight into local preferences, helping to tailor PPP approaches to co-benefits that are socially accepted (e.g., species richness in case of Ria de Aveiro). By identifying which outcomes matter most to national and local stakeholders, MCA supports the design of PPPs that align ecological objectives with community priorities, increasing the likelihood of sustaining restoration outcomes in a long term.

Key recommendations

- → Create **tailored financial plans for coastal wetland restoration sites** in Portugal. Systematically collect contextual and financial information on coastal wetland restoration sites to support creating tailored financial plans, using key elements from the RESTORE4Cs template to guide and structure the process. Combine public and private financing instruments in financial plans.
- → Use results of RESTORE4Cs (e.g., MCA) to **create a pilot public-private partnership in the Ria de Aveiro** to build trust, demonstrate feasibility, and attract replication across other regions in Portugal. Use the MCA results for the Ria de Aveiro as a basis for an extended follow-up MCA, if needed, to tailor PPP approaches to co-benefits that are socially acceptable: species richness, costs of restoration (investment and maintenance costs), cost of risk management (flood control and protection of the Ria banks), aquatic and habitats created, preserved or lost following restoration.
- → **Create and strengthen markets for ecosystem services.** The lack of market-based finance mechanisms (e.g., PES like biodiversity or blue carbon markets, eco-tourism investments) reflects regulatory and capacity gaps that must be addressed.

06

Stakeholder collaboration and partnerships

6. Stakeholder collaboration and partnerships

Establish clear competences of public authorities on coastal wetland restoration

- → **Identify public authorities with competences for coastal wetland restoration and conservation at national and regional levels.**
- → **Map institutional responsibilities across policy fields, including climate, nature, water, and coastal/marine protection and management.**
- → **Assess roles in policy development, planning, monitoring, and enforcement related to coastal wetland restoration and conservation.**
- → **Evaluate overlaps and gaps in competences to identify opportunities for improved coordination and conflict avoidance.**

Coastal wetlands are usually subject to the jurisdiction of various bodies and administrations. It is thus important to define clearly public authorities which are responsible for coastal wetland conservation and restoration and establish clear competences.

To identify needs for improvement in the governance setting, as a first step, the roles and duties on coastal wetland conservation and restoration across different governance levels and policy fields should be described and clarified:

- Both authorities in the national government and sub-national governments should be considered. At national level, the lead authority responsible for policy on coastal wetland restoration and conservation should be defined, and if there is more than one, the respective responsibilities clarified. At sub-national level, institutions responsible for restoration and conservation programmes on coastal wetlands should be identified. Since no regional government level is established in Portugal, deconcentrated regional governance level, created to manage regional issues and coordinate central government services at the regional (NUTS 2) level, should be analysed. The local level, consisting of 308 municipalities and 3,092 civil parishes[54], should be also analysed to define their general competences in coastal wetland conservation and restoration.
- Authorities in the main relevant policy fields should be taken into account, namely authorities with competence in climate change mitigation & adaptation, nature & biodiversity, water management, as well as coastal/marine planning and management. Often wetlands are effectively represented within nature restoration and water management policy fields, but their climate change mitigation role is less adequately captured in the governance setting where no public bodies are specifically responsible for coastal wetlands.
- It should be clarified which public authorities at national, sub-national, and local levels are responsible for policy, planning, monitoring, enforcement in the field of coastal wetland restoration and conservation.

Because of the location of coastal wetlands encompassing both land and sea and in many cases crossing administrative boundaries (e.g., in the case of Ria de Aveiro, Óbidos Lagoon, Tagus Estuary), there may be jurisdiction overlap in the designation of responsibilities concerning their management,

54 CoR – European Committee of the Regions, n.d., Portugal. European Committee of the Regions. https://portal.cor.europa.eu/divisionpowers/Pages/Portugal-intro.aspx.

resulting in confusion and economic, political, and management challenges[55]. It is thus important to identify such overlapping or unclear responsibilities among institutions and across different governance levels on coastal wetland restoration and conservation and whether such an overlap results in conflicts. Identifying these conflicts and areas of overlapping or unclear competences lays the basis for improving governance effectiveness in coastal wetland restoration and conservation.

Support from RESTORE4Cs

The main authorities responsible for coastal wetland conservation within the broader task of environmental protection in Portugal are presented in Table 14:

Table 14: Overview of Portugal´s public authorities responsible for various aspects of coastal wetland restoration and their respective responsibilities.

Name	Competences
National level	
Ministry of Environment and Energy	• Formulating, directing, executing and evaluating environmental, water, climate, coastal protection, nature conservation, biodiversity policies, from a perspective of sustainable development and social and territorial cohesion, as well as planning within its competence, including the coastline and rural areas. • Responsible for public marine domain, provides protection and funding if erosion affects an area landward of the public marine domain. • Overseeing of the Portuguese Environment Agency, Institute for Nature Conservation and Forests.
Ministry of Agriculture and Fisheries	• Formulating, conducting, enforcing and assessing the policy on food, agriculture, rural development, fisheries and aquaculture, maritime security and port protection, • Planning and coordinating the application of national and European funds for agriculture, rural development, fisheries, aquaculture, and works for port protection and maritime security in these fields, with the respective definition of the strategy and priorities, • Setting strategic sector guidelines on fisheries ports and all the activities in them.
Portuguese Environment Agency (APA)	• Responsible for proposing, developing, monitoring, and enforcing public policies for the environmental protection, working closely with other sectoral instruments and public and private stakeholders. • Its specific areas of intervention include water resource conservation, coastal protection and management, and the fight against climate change, among other topics. Each area of intervention has a dedicated department within the APA.
Institute for Nature Conservation and Forests (ICNF)	• Possesses administrative and financial powers within the indirect public administration of Portugal. • Planning, monitoring, and enforcement of nature conservation and forest policies, aiming at the protection, sustainable use, enhancement of natural heritage (EC, n.d.). • Responsible for managing the National Network of Protected Areas and the Portuguese Natura 2000 Network, which encompass numerous wetland ecosystems. • Is a designated Ramsar Administrative Authority, manages the Ramsar sites.

55 De Oliveira, M., Morrison, T., O'Brien, K. R., & Lovelock, C. E. (2024). Governance of coastal wetlands: Beyond the community conservation paradigm. Ocean & Coastal Management, 255, 107253. https://doi.org/10.1016/j.ocecoaman.2024.107253.

National Maritime Authority	• Enforcement of measures related to coastal wetlands. • Responsible for coast guard duties.
National Environmental Police	• Enforcement of measures related to coastal wetlands. • Prevention and repressing of the infringements to the environment.
Subnational level	
Intermunicipal Community Councils	• Promotion of the planning and management of the environmental development strategy of the territory covered. • Coordination of the municipal investments of intermunicipal interests.
Regional Coordination and Development Commissions	• Implementation of the environmental, territorial and urban planning and regional development policies: assessing environmental monitoring results (air, noise, waste), coordinating and managing environmental impact assessment (EIA) and post-evaluation processes, and participating in environmental licensing.
Local level	
Municipalities	• Responsible for policy planning, monitoring, and enforcement with close cooperation with the Portuguese Environmental Agency and the ICNF. • Implementation of disaster risk reduction policies.
Port Administrations	• Responsible for port areas, ensuring the safety of people, ships, goods, the environment. • Support within its jurisdictional area an innovative solution of aquatic biological diversity to mitigate anthropogenic pressures having natured-based artificial substrate units for biodiversity restoration.

Key recommendations

→ Consider establishing a **dedicated authority responsible for coastal wetland ecosystems** (see the example of the new Authority for the Venice Lagoon, Italy[20], intended as a unique body, "able to assume all competences presently distributed among various different actors") or a dedicated role within an existing public authority body. Enable knowledge and practice exchange with existing Member States´ authorities solely or primarily responsible for coastal wetland conservation and restoration to support the establishment of a specialised national body. The public authority body should have competences covering the variety of coastal wetland habitats based on their hydro-ecological characteristics and not limited by the protection regime borders (e.g., Ramsar, Natura 2000).

→ **Strengthen coordination and communication among responsible public authorities** by establishing inter-ministerial working groups that reflect the multifunctionality of coastal wetlands. Implement formal cooperation procedures, such as shared work programmes and joint consultation rounds, supported by an agreed timeline and a coherent, cross-sectoral internal strategy.

→ Use the present overview as a foundation for identifying more substantial overlaps or gaps in institutional competences. Build on this assessment to take stock of existing roles, clarify mandates, and **ensure that responsibilities are clearly defined and mutually coherent** across all relevant authorities.

→ Develop **structured procedures to ensure involvement of local authorities**, e.g. through intermunicipal communities, in the decision-making process regarding coastal wetland conservation and restoration.

→ Establish **clear mandates for coastal wetland restoration and conservation** for regional coordination and development commissions.

Establish a governance structure that enables collaboration between government agencies, scientists, NGOs and local communities

- → **Identify key stakeholders to be included in a governance structure that facilitates collaboration among government agencies, scientific institutions, NGOs, and local communities, and define their respective roles and responsibilities.**
- → **Assess mechanisms for incorporating local community interests into decision-making processes to ensure inclusivity and social acceptance of restoration actions.**

Regarding coastal wetlands conservation and restoration, the main national focal points and reporting authorities to the European Commission (EC) are the Portuguese Environmental Agency - APA (Agência Portuguesa do Ambiente) and the Institute for Nature Conservation and Forests - ICNF (Instituto da Conservação da Natureza e das Florestas) and, indirectly, Portugal's National Ramsar Administrative Authority, as ICNF is the primary national agency overseeing Ramsar implementation. APA acts as the national competent authority for environmental directives and regulations, including the Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD). APA submits official reports on water status, hydromorphology, and related measures that affect wetlands to the European Commission. The National Climate Authority – ANC (Autoridade Nacional do Clima) that is part of APA reports on greenhouse gas inventories under the LULUCF Regulation, including emissions and removals from wetlands. ICNF is responsible for biodiversity conservation and Natura 2000 site management, providing data for Habitats Directive (92/43/EEC) Article 17 reports and Natura 2000 Standard Data Forms, which include coastal wetland habitats. As well, ICNF is the entity responsible for managing and coordinating actions related to Wetlands of International Importance (Ramsar Sites) in Portugal. In addition, the Directorate-general for the Territory – DGT (Direção-Geral do Território) provides land-use data that feeds into EU reporting on spatial planning and habitat fragmentation.

Besides the reporting authorities to the EC, other entities are involved in the management of coastal wetlands, namely the Regional Hydrographic Administrations (Administrações de Região Hidrográfica – ARH). Operating under APA, ARH manage water resources at the regional level, including monitoring hydrological conditions and implementing measures that affect wetland connectivity and water quality status (WFD related). Municipal Authorities, as local governments, are responsible for implementing land-use plans and enforcing zoning regulations that can protect or impact coastal wetlands. They often collaborate in restoration projects and public consultations, to which Scientific and Academic Institutions can participate, as well as NGOs and Civil Society Organizations. Environmental NGOs contribute to advocacy, awareness campaigns, and sometimes co-manage restoration projects with public authorities. Relevant examples of Portuguese Environmental NGOs acting at national level are: Portuguese Society for the Study of Birds – SPEA (Sociedade Portuguesa para o Estudo das Aves), focusing on birds conservation, wetlands protection and biodiversity monitoring; League for Nature Protection - LPN (Liga para a Proteção da Natureza), acting on habitat conservation, environmental education, and policy advocacy; National Association for Nature Conservation - Quercus (Associação Nacional de Conservação da Natureza) fucusing on environmental advocacy, including wetlands, forests, and climate issues; and Sustainable Earth System Association - ZERO (Associação Sistema Terrestre Sustentável) acting on climate action, sustainable development, and environmental policy monitoring. In addition to the entities listed, local community representatives, such as associations of fishers, farmers, tourism operators, and other user groups, are increasingly recognized as key stakeholders in coastal wetland governance. Their participation is facilitated through public consultations, stakeholder forums, and, in some cases, co-management

committees established for Natura 2000 sites or Ramsar wetlands. These mechanisms ensure that local knowledge, interests, and concerns are incorporated into planning and decision-making, thereby enhancing the social acceptance and long-term sustainability of restoration actions.

Key recommendations

- → Conduct an extensive **stakeholder mapping** in prioritised restoration sites which involves identifying all relevant actors (governmental institutions, NGOs, scientists, private companies, local communities, and international bodies) and clarifying their roles in coastal wetland restoration. By assessing each stakeholder's interest in and influence on restoration, a targeted communication and involvement strategy can be developed to ensure that high-influence actors are involved while high-interest groups are empowered through participation and capacity building.
- → Establish **participatory committee** for priority restoration areas, creating an inclusive platform for dialogue, enabling different stakeholder groups to contribute to planning, implementation, and monitoring of restoration activities. These committees should include clear conflict-resolution procedures, topic-specific working groups such as for climate change mitigation and carbon storage, and transparent communication to maintain trust and accountability.
- → Build partnerships with the **European Community of Practice for Coastal Wetland Restoration (ECoP)**[56] to facilitate the exchange of knowledge, innovative methodologies, and best practices, connecting local restoration work with international expertise.

56 The European Community of Practice for Coastal Wetland Restoration (ECoP) was initiated during the RESTORE4Cs project and aims to mobilise a wide range of stakeholders to accelerate joint action for restoring and conserving wetlands across Europe and beyond. See Section 7 for more details.

07

Enabling capacities and raising awareness

7. Enabling capacities and raising awareness

The planning of coastal wetland restoration depends not only on sound science and policy, but also on the capacity of institutions, stakeholders, and the wider public to support these efforts. Often, the understanding of values that coastal wetlands and their restoration deliver is lacking among the broader public and decision-makers. This gap often leads to undervaluing wetlands compared with competing land uses, making restoration projects more difficult to justify, fund, or implement.

RESTORE4Cs research identified a low awareness and limited knowledge of climate change mitigation potential and benefits of restored coastal wetlands among local stakeholders. This affects the social acceptance of restoration actions and, hence, their overall viability[57]. These findings indicate the need for stronger engagement, trainings opportunities, and wider information dissemination among local actors. In this context, it is important to provide a broader perspective and to communicate about benefits of restoration holistically, rather than focusing solely on climate change mitigation, to achieve a higher level of stakeholder mobilisation. Specifically, as in the Danube Delta context, stakeholders have identified water quality and flow improvement as essential topics to consider while planning and implementing a restoration project, it would be important to show an interlinkage between climate regulation and water cycle benefits of coastal wetland restoration in the region.

Strengthening capacity and local skills, e.g., through training or dedicated allocation of resources (money, time, personnel), helps ensure that organisations can plan, manage, and monitor restoration effectively. Training sessions, built on the latest scientific knowledge and addressing key knowledge gaps in a clear and structured way, serve as another important communication tool in coastal wetland restoration, creating opportunities for knowledge exchange, capacity building, and collaborative learning among stakeholders. Likewise, raising awareness, including among local communities, landowners, industry, decision-makers, builds trust and encourages shared stewardship of restored areas. Building such capacities and raising awareness is a key pillar of roadmap and strategy for coastal wetland restoration.

Communication and dissemination activities play an important role in increasing the visibility of the restoration project results, using clear and accessible language, raising awareness and supporting engagement of stakeholders and creation of new partnerships. When tailored to the specifics of each target audience, communication helps connect science with the broader public, building social license, and support evidence-based policy.

The RESTORE4Cs Community of Practice for Wetland Restoration (ECoP)

The ECoP initiated during the RESTORE4Cs project seeks to mobilise a wide range of stakeholders to accelerate joint action for restoring and conserving wetlands across Europe and beyond. By involving site managers, private businesses, researchers, decision-makers, civil society organisations and other restoration champions, this Community aims to:

- **Act as a knowledge hub** for practitioners and experts seeking guidance on implementing wetland restoration strategies that optimise carbon sequestration and reduce greenhouse gas emissions.

57 Sella, L. et al. (2025). Social acceptability of wetland restoration and management. Deliverable. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

- **Promote cross-regional learning and the replication of successful restoration approaches** by facilitating exchanges between experts working in different ecological, cultural, and regulatory contexts. By showcasing best management practices and proven restoration techniques, the Community encourages members to adapt, adopt, and scale up effective solutions in their own regions.

This community seeks to cultivate a collaborative and respectful environment for learning and growth, where members can:

- build knowledge and skills collectively;
- identify training needs from different actors;
- co-design new training materials and initiatives.

The RESTORE4Cs Community of Practice is hosted on the Wetland-based Solutions platform (https://www.wetlandbasedsolutions.org/). Joining and participating in the Community is possible via https://www.wetlandbasedsolutions.org/community-of-practice-wetlands/.

Key recommendations to authorities

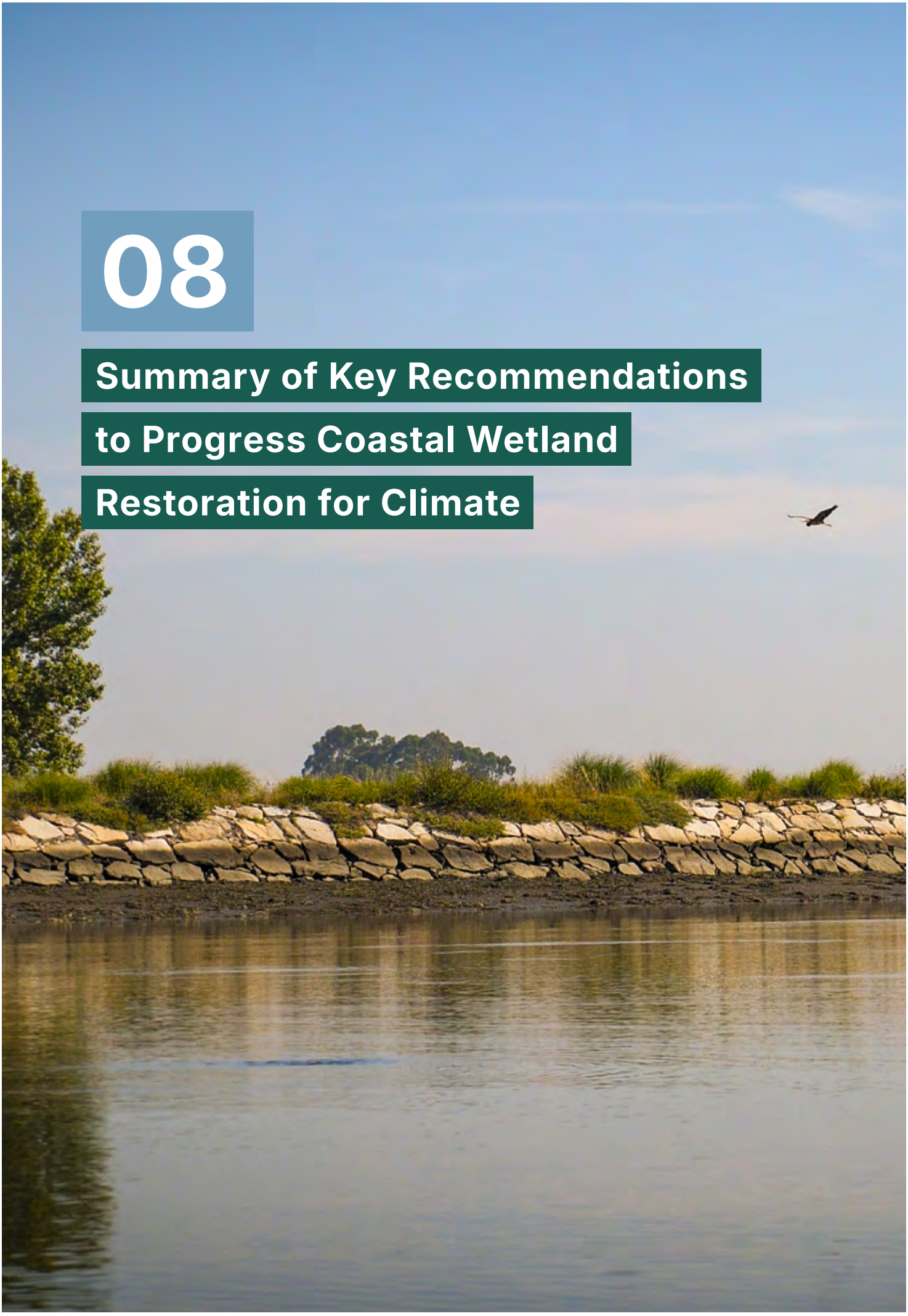
→ Improve communication on and raise awareness of the **ecological importance of coastal wetlands, their value in ensuring social and economic sustainability of local communities and their role in biodiversity conservation, carbon storage, disaster risk reduction and climate adaptation** (wetland restoration as key investment in resilience).

→ **Demonstrate effectiveness** of coastal wetlands in addressing societal challenges and their **value for money.**

→ **Involve communities, engage local actors directly** and show case real-world examples of co-benefits.

→ **Link coastal wetlands recovery to improvements in life quality** of general public.

→ Organise **targeted trainings** to build capacities and improve the understanding and knowledge of benefits of coastal wetland restoration, especially with relation to climate change mitigation potential and benefits of restoration.



08

Summary of Key Recommendations to Progress Coastal Wetland Restoration for Climate

8. Summary of Key Recommendations to Progress Coastal Wetland Restoration for Climate

The main recommendations can be summarised as follows:

- → **Establish a clear national framework for coastal wetlands –** Adopt a consistent national definition and typology for coastal wetlands, harmonized with Ramsar and the EU Nature Restoration Regulation (NRR). This will improve coherence in monitoring, planning, and reporting, ensuring that all relevant wetland types are recognized and managed appropriately.
- → **Develop a national wetland strategy with restoration targets –** Move beyond site-specific protection by developing a comprehensive national wetland strategy that integrates binding conservation and restoration targets for coastal and transitional wetland systems. The ongoing development of the National Restoration Plan, as outlined in recent legislation, provides a timely opportunity to embed these targets and leverage the momentum created by the EU NRR.
- → **Strengthen condition assessment and monitoring –** Complete the mapping of all coastal wetlands, including those outside Natura 2000, and establish a national system for assessing wetland ecological condition, building on RESTORE4Cs indicators and remote sensing tools. This will enable a shift from designation-based protection to condition-based management, supporting adaptive restoration and more effective policy implementation.
- → **Prioritise restoration where ecological potential, feasibility, and priority benefits overlap –** Focus restoration efforts on areas where ecological feasibility, restoration potential, and priority benefits coincide—particularly in degraded estuarine margins, saltmarsh edges, lagoon peripheries, and historical floodplains. This approach will maximize biodiversity, connectivity, and climate change mitigation outcomes.
- → **Address key pressures through integrated water and land management –** Tackle eutrophication, hydrological alteration, and climate-related salinisation and drought through coordinated water management, pollution reduction, and nature-based solutions. Integrated management will help restore ecological integrity and resilience in coastal wetlands.
- → **Integrate climate change mitigation into wetland policy –** Explicitly recognize coastal wetlands as assets for climate change mitigation and adaptation. Improve data on carbon storage and greenhouse gas fluxes and integrate wetlands into national LULUCF accounting and climate strategies, including blue carbon habitats such as saltmarshes and seagrass beds. Rapid implementation of the 'Floresta Azul' program (Portaria n.º 442/2025/1) for seagrass and saltmarsh restoration is a critical step, including mapping, carbon quantification, and integration into the National Emissions Inventory.
- → **Capture restoration benefits beyond climate impacts –** Restoration planning should assess not only climate benefits but also social and economic co-benefits. Using multi-criteria analysis (MCA) and stakeholder engagement ensures restoration actions deliver broad value and are adapted to local contexts.
- → **Develop a long-term financing plan for restoration –** Create tailored financial plans for coastal wetland restoration sites, securing both investment and maintenance funding. Blended finance mechanisms, such as payments for ecosystem services (PES), carbon or biodiversity markets, and environmental funds, should be integrated to engage private stakeholders and ensure sustainability.

- → **Strengthen institutional competences and coordination –** Establish a dedicated authority for coastal wetlands, or strengthen existing bodies, to improve regulatory, ecological, and financial coordination. Interministerial working groups should be created to ensure coherent action across sectors. Restoration planning should be fully aligned with Natura 2000, Ramsar, and national protected area objectives, maximizing synergies with existing conservation frameworks and using multi-criteria analysis to rank and select restoration sites.
- → **Adopt a participatory governance model and build capacity –** Implement a participatory governance model for coastal wetland restoration, including site-specific committees and structured cooperation with the European Community of Practice for Coastal Wetland Restoration (ECoP). This will ensure inclusive decision-making, grounded in scientific expertise and best practice exchange. Capacity building and awareness-raising should be prioritized, with targeted trainings and communication efforts to highlight the ecological, social, and economic value of coastal wetlands, linking restoration to improvements in quality of life and resilience for local communities.

References

APA (2024). Programas da Orla Costeira. Available at: https://apambiente.pt/agua/programas-da-orla-costeira.

APA (2024). Planos de Gestão de Região Hidrográfica. Available at: https://apambiente.pt/agua/planos-de-gestao-de-regiao-hidrografica.

Ascenzi, G., Grace, E., Bhattacharjee, A., Silva, L.N., and Cassola, R. (2025). Restoration Project Developers' Playbook on Private Finance (Europe). UN Environment Programme World Conservation Monitoring Centre. Cambridge UK https://doi.org/10.34892/rma6-d142.

Cavaco, C., Mourato, J., Costa, J.P., Pereira, A., Vilares, E., Moreira, P. & Magalhães, M. (2021), Spatial Planning and Regional Development in Portugal. Lisboa: Direção-Geral do Território.

CoR – European Committee of the Regions, n.d., Portugal. European Committee of the Regions. https://portal.cor.europa.eu/divisionpowers/Pages/Portugal-intro.aspx.

De Oliveira, R. X. (2023). Blue Carbon: A Roadmap for a Voluntary Market in Portugal. Elaborated by ANP|WWF as part of the Gulbenkian Blue Carbon project. Available at: https://cdn.gulbenkian.pt/wp-content/uploads/2024/06/FCG_EN_BlueCarbon_Roadmap.pdf.

De Oliveira, M., Morrison, T., O'Brien, K. R., & Lovelock, C. E. (2024). Governance of coastal wetlands: Beyond the community conservation paradigm. Ocean & Coastal Management, 255, 107253. https://doi.org/10.1016/j.ocecoaman.2024.107253.

EC (2024). Portugal – Final updated National Energy and Climate Plan (NECP) 2021-2030 (submitted in 2024). https://commission.europa.eu/document/download/f12fd5f8-605b-481c-9690-6b86fe2d48e3_en?filename=Final%20NECP_20241118_pnec2030_para_aprov_ar_EN.pdf.

EC, Directorate-General for Agriculture and Rural Development. (n.d.). How can participatory methods enable communication and the embedding of the output from a multi-actor project? EU CAP Network. Available at: https://eu-cap-network.ec.europa.eu/projects/practice-abstracts/how-can-participatory-methods-enable-communication-and-embedding-output_en?utm_source=chatgpt.com.

IEEP (2023) Exploring policy options for funding nature restoration in the next MFF: report of a workshop discussion. Institute for European Environmental Policy, Brussels.

Kruk, R. W., De Blust, G., Apeldoorn, R.C., Bouwma, I. & Sier, A. (2009), Organising the management of Natura2000 sites in 27 EU Member States (Summary). https://www.miteco.gob.es/content/dam/miteco/es/biodiversidad/publicaciones/management_n2000_tcm30-197177.pdf.

Louro e Costa, J., & de Soet Palmeiro, J. (2023), Portugal: Environment. In J. M. Auslander & B. J. Detterman (Eds.), Environment. Lexology. Getting the deal through. London: Law Business Research.

Maia, A., Bernardes, C., & Alves, M. (2014). Cost-benefit analysis of coastal defenses on the Vagueira and Labrego beaches in North West Portugal. Revista De Gestão Costeira Integrada, 81–90. https://doi.org/10.5894/rgci521.

Ostrom, E. (2011). Background on the institutional analysis and development framework. In M. Poteete, A. Janssen, & E. Ostrom, Working together: Collective action, the commons, and multiple methods in practice (pp. 7–27). Princeton University Press. Available at: https://idahoecosystems.org/sites/default/files/literature_resource/sustainable_social-ecological_systems_ostrom_2011.pdf.

Ramsar Convention. (1971). Convention on Wetlands of International Importance especially as Waterfowl Habitat (Art. 1). Ramsar, Iran. Available at: https://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf.

Ramsar Convention Secretariat (2021), Ramsar National Report to COP14. Ramsar. https://www.ramsar.org/sites/default/files/documents/importftp/COP14NR_Portugal_e.pdf.

Ramsar Convention Secretariat (2025), Ramsar National Report to COP15. Ramsar. https://www.ramsar.org/sites/default/files/2025-03/COP15NR_Portugal_e.pdf.

Republica Portuguesa (2025). Government signals the start of the Voluntary Carbon Market. Available at: https://www.portugal.gov.pt/en/gc25/communication/news-item?i=governo-signals-the-start-of-the-voluntary-carbon-market.

RESTORE4Cs. (2025). Ria de Aveiro. RESTORE4Cs project. Available at: https://www.restore4cs.eu/case-pilots/.

Santos, R., Ito, P., de los Santos, C.B. (2023). Assessment of blue carbon ecosystems in mainland Portugal. Gulbenkian Blue Carbon Project. Scientific-technical report. Centro de Ciências do Mar. Faro, September 2023. 56 pp.

Santos, R., Ito, P., de los Santos, C.B. (2023). The 10 main blue carbon ecosystems in mainland Portugal. Gulbenkian Blue Carbon Project. Scientific-technical report. Centro de Ciências do Mar. Faro, September 2023. 142 pp.

Terisse, A. et al. (2023). Characterising supportive governance and policy. Deliverable. WaterLands. Available at: https://cdn.sanity.io/files/34jdpbeg/production/5998e2ff94dad02b23da477813737a84c763070a.pdf.

UNEA. (2022). Nature-based solutions for supporting sustainable development. United Nations Environment Resolution UNEP/EA.5/Res.5. Available at: https://wedocs.unep.org/rest/api/core/bitstreams/4caa2911-37ea-4915-b378-d2c2d525ee35/content.

RESTORE4Cs Products

Anglada, C., Massoutier, J., Lago, M., Ciravegna, E., Raoult, J., Polman, N., Bodivit, A., Sella, L., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Bučas, M., Beekman, V., Geamana, N., Giuca, R.C., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M.J., Morant, D., Rota, F.S., Štrbenac, A., Oliveira, B., & Lillebø, A. (2025). Report on cost/benefit analysis of wetland restoration options and on financing tools. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Cabrera-Brufau, Miguel, Camille Minaudo, Katrin Attermeyer, Alba Camacho-Santamans, Rafael Carballeira, Benjamin Misteli, Jorge Juan Montes-Pérez, Daniel Morant, Biel Obrador, Antonio Picazo, Carlos Rochera, Mihai Adamescu, Raquel Ambrosio, Giancarlo Bachi, Nina Bègue, Martynas Bučas, Lídia Cañas Ramírez, Marco Carloni, Lamara Cavalcante, Constantin Cazacu, Giovanni Checcucci, João Pedro Coelho, Valentin Dinu, Valtere Evangelista, Ilenia Férez Martín, Jonas Gintauskas, Relu Giuca, Anis Guelmami, Mirco Guerrazzi, Samuel Hilaire, Marija Kataržytė, Ana I. Lillebø, Raquel Lizán, Bruna R.F. Oliveira, Vitor H. Oliveira, Marta Pedrón, Jolita Petkuvienė, Tudor Racoviceanu, Michael Ronse, Chiara Santinelli, Ana Sousa, Wouter Suykerbuyk, Edvinas Tiškus, Claudia Tropea, Diana Vaičiūtė, Silvia Valsecchi, Marinka E.B. van Puijenbroek, Mourine J. Yegon, Antonio Camacho, Daniel von Schiller (2025) Assessing the effects of restoration and conservation on gaseous carbon fluxes and climate mitigation capacity across six European coastal wetlands. Preprint. https://doi.org/10.31223/X5PB36; https://eartharxiv.org/repository/view/11235/.

Kampa, E., Bueb, B., Elkina, E., Otero, M.M., Abdul Malak, D., Schröder, C., Sanchez, A., Guelmami, A., Ronse, M., Kataržytė, M., Vaičiūtė, D., Bučas, M., Raoult, J., Speijer, F., Lillebø, A., Carvalho, T., Geamănaă, N., Cazacu, C., Racoviceanu, T., & Camacho, A. (2024). Policy analysis and policy demands for data, methods, and tools (Part A). Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

Otero, M. M., Abdul Malak, D., Sanchez A., Schröder, C., Kampa, E., Bueb B., Elkina, E., Guelmami, A.,Camacho, A., Marangui, C., Lillebø, A. (2025). European Coastal Wetland Indicators: A proposal for monitoring policy process across space and time. Policy brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-6-v2_Final.pdf.

Otero, M., Camacho, A., Abdul Malak, D., Kampa, E., Scheid, A., & Elkina, E. (2024). How can coastal wetlands help achieve EU climate goals? Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

Sella, L., Rota, F. S., Pollo, N., Vivaldo, G., Anglada, C., De Fusco, G., Ciravegna, E., Massoutier, J., Bodivit, A., Khavandgaran, S., Omidmand, M., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Beekman, V., Polman, N., Raoult, J., Giuca, R. C., Geamana, N., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M. J., Morant, D., Štrbenac, A., Lillebø, A., Sousa, A., Coelho, P., & Oliveira, B. (2025). Social acceptability of wetland restoration and management. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Restoring Coastal Wetlands in Europe

Pilot roadmap on coastal wetland restoration in Romania

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Executive Summary

Planning the restoration of coastal wetland habitats is a key element for National Restoration Plans under the EU Nature Restoration Regulation, national commitments under the Ramsar Convention as well as reporting requirements on wetlands emissions and removals under the EU Regulation on Land Use, Land Use Change and Forestry.

This pilot roadmap is designed to support national authorities and stakeholders in Romania in developing a strategic framework for planning coastal wetland restoration, for example in the context of National Restoration Plans. It draws on the latest scientific data, tools and methods developed by the EU-funded project RESTORE4Cs. The roadmap follows the step-wise approach set out in the RESTORE4Cs Implementation Roadmap to Guide National Action for coastal wetland restoration, thereby contributing to the achievement of key policy targets for climate and biodiversity.

About the project

RESTORE4Cs (Modelling **RESTOR**ation of w**E**tlands for **C**arbon pathways, **C**limate **C**hange mitigation and adaptation, ecosystem services, and biodiversity, **C**o-benefits) is a Horizon Europe project led by the University of Aveiro, which evaluated the effect of restoration actions on wetlands´ ability to mitigate climate change and provide various ecosystem services. Its mission is to support the implementation of EU climate and biodiversity policies, by:

- gathering effectiveness data on restoration and land use management actions;
- structuring a European Community of Practice;
- upscaling models and integrative assessment tools;
- designing a multi-actor approach for stakeholder engagement.

RESTORE4Cs identified six Case Pilots for its activities. These comprise coastal wetland ecosystems in different states of preservation, with various alterations, and offering a range of restoration measure types already in place.

The six Case Pilot sites provide a good geographical representation within Europe and its biogeographical regions: Mediterranean (Valencian Wetlands in Spain and Camargue in France), Atlantic (Ria de Aveiro in Portugal and South-West Dutch Delta in the Netherlands), Baltic (Curonian Lagoon in Lithuania) and the Black Sea (Danube Delta in Romania).

Project´s results are available through a digital platform serving as a Decision Support System (DSS) for stakeholders and wetland practitioners and providing more reliable information to drive and prioritise wetlands restoration actions.

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List of Abbreviations

CAP	Common Agricultural Policy
CEE	Central and Eastern Europe
CH_4	Methane
CLC	CORINE Land Cover
CO_2	Carbon Dioxide
CORINE	Coordination of Information on the Environment
CRCF Regulation	Carbon Removal and Carbon Farming Regulation
DDBRA	Danube Delta Biosphere Reserve Administration
DDNI	Danube Delta National Institute for Research and Development
EC	European Commission
ECoP	European Community of Practice
EEA	European Environment Agency
EU	European Union
FRMP	Flood Risk Management Plan
GAEC	Good Agricultural and Environmental Conditions
GHG	Greenhouse Gas
GIS	Geographic Information System
ICPDR	International Commission for the Protection of the Danube River
LULC	Land-Use/Land-Cover
LULUCF	Land Use, Land-Use Change and Forestry
MCA	Multi-Criteria Analysis
MSFD	Marine Strategy Framework Directive
N_2O	Nitrous Oxide
NBASP	National Strategy and Action Plan for Biodiversity Conservation 2014–2020
NbS	Nature-based Solutions
NECP	National Energy and Climate Plans
NGO	Non-Governmental Organisation
NIMRD	National Institute for Marine Research and Development “Grigore Antipa”
NRR	Nature Restoration Regulation

NUTS	Nomenclature of Territorial Units for Statistics
PES	Payment for Ecosystem Services
PNRR	National Recovery and Resilience Plan
PRW	Potentially Restorable Wetlands
PSU	Practical Salinity Unit
PWA	Potential Wetland Areas
RBMP	River Basin Management Plan
SOR	Romanian Ontological Society
UAA	Utilised Agricultural Area
UNEA	United Nations Environment Assembly
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WEI	Water Exploitation Index
WFD	Water Framework Directive
WP	Work Package

Glossary

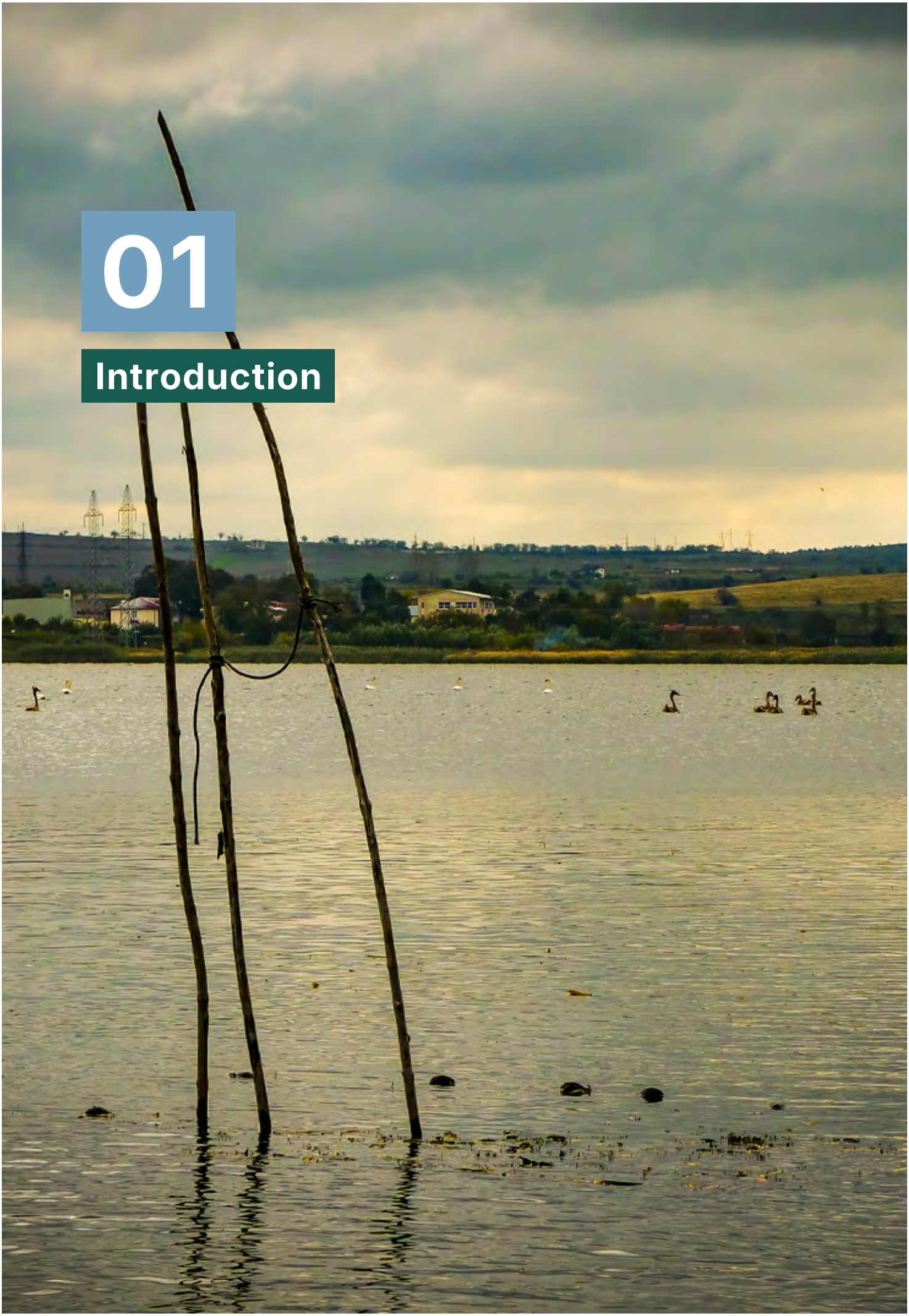
Active restoration	Process that eliminates the source of degradation and disturbance of an ecosystem and implements measures to accelerate its recovery and overcome obstacles to that recovery.
Coastal wetlands	Coastal wetlands are areas along coastlines that are temporarily or permanently flooded by salt, brackish or fresh water. These ecosystems are characterised by phreatophylic and submerged vegetation. According to the Ramsar Convention, coastal wetlands include "water that is static or flowing, fresh, brackish or salty, including areas of marine water the depth of which at low tide does not exceed six meters"[1]. European coastal wetlands include seagrass, tidal and freshwater marshes as well as tidal and non-tidal flats and creeks. These habitats can be found in coastal lagoons, estuaries, and other transitional waters, as well as in fjords, sea lochs, and embayments[2]. This harmonised definition of coastal wetlands was developed based on the work conducted in the RESTORE4Cs Horizon Europe project. It is aligned with the Ramsar Convention and captures the full land-sea-continuum.
Index	An index is a composite measure that combines multiple variables to provide a comprehensive overview of a specific issue or performance area. Indexes are often used to simplify complex data sets and present a broad picture of trends and changes over time. An example of an index could be the Coastal Wetland Health Condition Index, which might include indicators related to water quality, biodiversity, and habitat extent.
Metric	A metric is a quantifiable measure used to track and assess the status of a specific process or activity. Metrics are usually more granular and detailed than indicators and can be used to support the calculation of indicators and indexes. For example, a metric for coastal wetland health might be the number of bird species observed in a wetland area or the concentration of pollutants in wetland water.
Nature-based solution	Nature-based solutions are actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services, resilience and biodiversity benefits[3].
Passive restoration	Process that eliminates the factors of degradation and disturbance and permits the natural regeneration of the ecosystem.

1 Ramsar Convention. (1971). *Convention on Wetlands of International Importance especially as Waterfowl Habitat*. Ramsar Secretariat. Ramsar, Iran. Available at: https://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf.

2 Otero, M. et al. (2024). *How can coastal wetlands help achieve EU climate goals?* Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

3 United Nations Environment Assembly (UNEA). (2022). *Nature-based solutions for supporting sustainable development.* United Nations Environment Resolution UNEP/EA.5/Res.5. Available at: https://wedocs.unep.org/rest/api/core/bitstreams/4caa2911-37ea-4915-b378-d2c2d525ee35/content.

Policy indicator	A policy indicator is a specific, measurable element used to assess and track progress towards achieving policy goals and objectives, focusing on inputs, output and outcome measures. These indicators are designed to provide timely, relevant information that informs decision-makers about the effectiveness of policies. They are based on criteria that aim to capture the relevance for the targeted (policy) questions by providing timely, relevant information on the coastal wetlands and data characteristics, which require spatially explicit and quantity-specific data and metrics, e.g. descriptive statistics, coverage, type, scale and/or year. For example, a policy indicator for coastal wetland restoration might be the percentage increase in restored wetland areas.
Stakeholder	Any group or individual who can affect or is affected by wetland management.
Wetland management	Refers to the policies, practices and actions taken to maintain or restore the natural state and functions of wetland ecosystems. This involves a balance between the conservation of wetlands for their ecological benefits and the sustainable use of these areas for human needs. The goal is to ensure that wetlands continue to provide their essential services to humans and nature. Effective wetlands management strategies may include protecting wetlands from anthropogenic threats, regulating water levels to mimic natural cycles and prevent degradation, restoring wetland habitats that have been lost, damaged or degraded, implementing policies that encourage sustainable use and conservation efforts.
Wetland restoration	A key aspect of wetlands management is the restoration of lost or altered wetlands. This process often involves re-establishing the natural water flow, removing pollutants, replanting native vegetation or re-creating lost wetland habitats. Restoration projects have been shown to not only bring back lost wetland functions but also to enhance resilience against climate change impacts. Successful wetland restoration efforts can also lead to significant environmental and social benefits.



01

Introduction

1. Introduction

Aim of implementation roadmap on coastal wetland restoration

Romania is home to the Danube Delta, one of Europe's largest and most ecologically significant wetlands, recognised as a UNESCO World Heritage Site and a Ramsar site. This area supports exceptional biodiversity and provides important ecosystem services, but it faces pressures from land-use changes, agriculture, and economic development. Conservation efforts have included the establishment of the protected area, international cooperation works for conservation and knowledge and pilot restoration projects aimed at reversing habitat degradation. However, challenges such as fragmented land-ownership, limited enforcement of environmental regulations, and competing economic interests continue to hinder large-scale restoration.

At the same time, in Romania, it is necessary to promote the initiation and development of national policy on the ecological restoration of wetlands, taking into account the existence of the Danube Delta, a wetland of global interest on its territory that requires restoration. This document presents a pilot roadmap for implementing coastal wetland restoration in Romania, aiming to support authorities in planning restoration in the context of the new EU Nature Restoration Regulation (NRR). By developing and implementing a comprehensive roadmap, national and local authorities can address multiple environmental, social, and economic challenges simultaneously, fostering a sustainable and resilient future.

In particular, the goal and scope of this roadmap is to:

- Provide **insights and guidance for national authorities & practitioners in Romania on how to use the tools and results of the RESTORE4Cs Horizon Europe project** to improve the planning of coastal wetland restoration.
- Support national authorities in **defining priorities for coastal wetland restoration** to contribute to the achievement of key policy targets for climate and biodiversity.

Europe's coastal wetlands are critical ecosystems which can play a crucial role in climate change mitigation and adaptation[4]. When restored, they act as nature-based solutions: reducing greenhouse gas emissions (GHG), removing CO_2 from the atmosphere[5], and acting as natural sponges in the landscape that buffer the impacts of both floods and droughts.

Since 2023, the EU-funded RESTORE4Cs project has been working on the evaluation of the effects of restoration actions on coastal wetlands' ability to mitigate climate change and on the development of methods and tools to support decision-making on coastal wetland restoration. The Danube Delta was selected as one of the case pilots of RESTORE4Cs to gather data and information on GHG fluxes (CO_2, CH_4) under different conservation and use scenarios[6]. This data and information together with data from other case pilots have contributed to improving the knowledge on wetlands' status, their restoration potential and their capacity as carbon sinks or GHG sources.

4 Otero, M. et al. (2024). How can coastal wetlands help achieve EU climate goals? Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

5 Ibid.

6 RESTORE4Cs. (2025). Danube Delta. RESTORE4Cs project. Available at: https://www.restore4cs.eu/case-pilots/danube-delta/.

RESTORE4Cs is a Horizon Europe project that aims to evaluate the effects of restoration actions on wetlands' ability to mitigate climate change and deliver a range of ecosystem services, using an integrative socio-ecological systems approach. More information is available at:
https://www.restore4cs.eu/

Key implementation challenges for coastal wetlands restoration

Coastal wetland restoration in Romania faces a number of implementation challenges, which relate to policy and governance issues, data gaps, planning difficulties and lack of engagement and awareness activities. The table below elaborates the most important implementation challenges (dark orange cells) and other important challenges (light orange) to coastal wetland restoration in Romania. These challenges were identified using expert knowledge of RESTORE4Cs project partners, the analysis of national policies, as well as feedback from stakeholders in the RESTORE4Cs workshops and consultations relevant to the roadmap development.

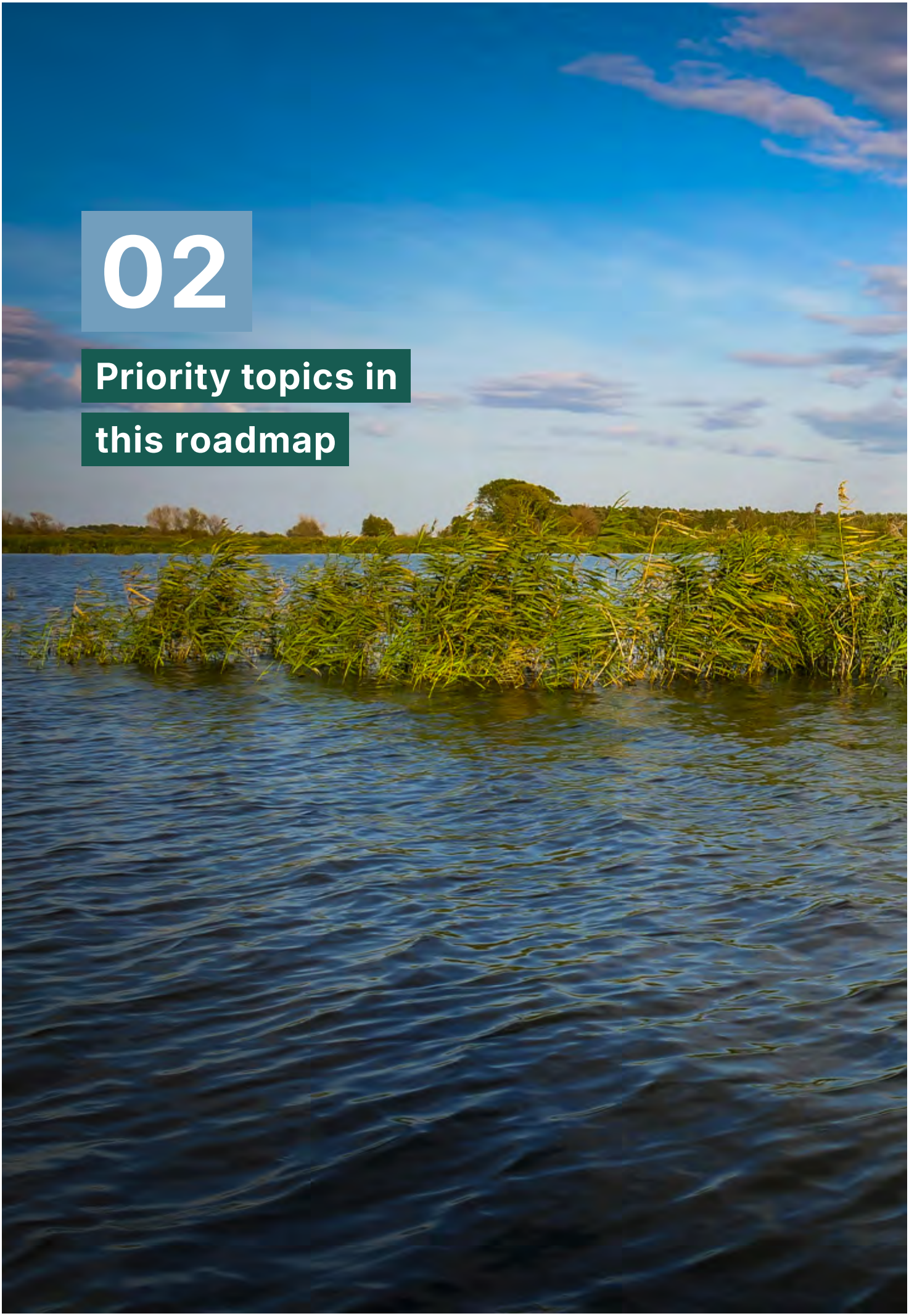
Most important implementation challenges are summarised as follows:

- Lack of legally binding restoration targets and weak institutional coordination, including unclear and overlapping competences of public authorities, hinder restoration efforts.
- Lack of standardised monitoring system and a system of national indicators to measure wetland health and progress of restoration.
- Competing land-use and economic interests such as agricultural expansion, even in the Danube Delta, conflict with restoration goals. At the same time, the local population begins to realise that current land use practices (e.g., agriculture) are not highly efficient in terms of benefits they are receiving, in contrast with traditional practices (fishing and aquaculture) There is growing awareness that eco-tourism offers greater long-term benefits. Consequently, local perceptions are shifting, and restoration programs are increasingly seen as beneficial for all stakeholders, including local residents and economic agencies.
- Effective participation in wetland restoration planning remains limited due to the absence of structured participatory frameworks and clear incentives targeted at low impact aquaculture and sustainable conservation practices. Existing incentives for agriculture under the CAP are encouraging intensive agricultural practices.

Table 1: Key challenges for implementing coastal wetland restoration in Romania (dark orange – most important implementation challenges; light orange - other important challenges to coastal wetland restoration).

Key challenges for implementing coastal wetland restoration in Romania	
Policy and governance	Currently no national strategy for wetland conservation and sustainable development, that integrates binding restoration targets. The lack of legally binding restoration goals results in a limited number of restoration projects being initiated
	Insufficient coordination among institutions. No single authority has a clear mandate for coastal wetlands. Cross-sectoral coordination is weak
	Fragmented system of land property and management of water infrastructure (e.g. dykes), riparian land and water bodies. This fragmentation leads to overlapping responsibilities and unclear competences.

	Lack of coherence between environmental and sectoral priorities: Contradicting sectoral priorities mainly from agriculture
	While the Danube Delta is a key focus for restoration, upstream impacts and management practices also play a critical role. Transboundary cooperation in the Danube basin is complex. Danube River Basin spans 19 countries, making coordination and overcoming technical challenges for restoration projects extremely difficult
	Lack of political attention
Data	No national agreement on monitoring indicators on coastal wetland health, status and restoration to be measured; lack of uniform indicators
	No national system for monitoring and classification of wetland health (lack of standardised monitoring methods)
	Lack of public data on GHG-fluxes and carbon storage of coastal wetlands: Wetlands are missing from Romania's LULUCF accounting and NECP. Their potential on restoration actions for GHG mitigation and climate adaptation is underutilised. GHG flux data and technical expertise are limited to a few institutions
Planning and prioritisation for restoration	Conflicting land uses and focus on infrastructure development. Restoring wetlands often requires aligning the interests of multiple local landowners and stakeholders (agricultural, aquaculture, and tourism), which can be a complex process
	Lack of procedure to determine which areas are most important for implementing restoration projects. So far, only projects related to dredging have been carried out
Stakeholder engagement and awareness	Without adequate compensation mechanisms (e.g., subsidies, payments for ecosystem services), incentives for restoration on privately owned land remain limited (as local communities often depend on economic activities for their livelihood, making it difficult to reconcile economic interests and conservation goals). On public land, insufficient stakeholder engagement and long-term governance can constrain restoration success. Consequently, restoration efforts that rely mainly on voluntary commitment often face implementation challenges.
	Lack of awareness-raising activities: Not many disseminations and awareness raising activities done by NGOs or by academia targeted at local population and public. There is low public awareness of the climate and biodiversity benefits of wetland restoration
	Lack of stakeholder participation and institutional action to facilitate it: Stakeholder participation is inconsistent and often ad hoc. There is no standardised or consistent framework to ensure meaningful stakeholder involvement.
	Communication challenges between stakeholders: Difficulty in disseminating information from research projects which highlight the benefits of wetland restoration
Funding	Restoration relies on short-term EU project funding. Romania lacks long-term, dedicated financing tools, such as carbon credit schemes or national co-financing mechanisms. Although EU funding is available, it can be problematic to access it due to strict selection criteria, lack of capacity of the Danube Delta administration to become involved and excessive bureaucracy (e.g. for CAP measures relevant to farmers).



02

Priority topics in this roadmap

2. Priority topics in this roadmap

This pilot roadmap on coastal wetland restoration in Romania is structured in a stepwise approach which follows a decision-making logic:

- It starts with a baseline assessment at national level, with key information on the main characteristics and conditions of coastal wetlands in Romania and alignment of roadmap with national policies and targets
- It then moves to the operationalisation of relevant policy targets with appropriate indicators, and the identification of potentially restorable wetlands.
- It then proceeds to the assessment of benefits and costs as key aspect in planning suitable restoration actions at the site level.

The roadmap elaborates on decision-making steps which have been identified as priority needs for further development in Romania and which can benefit from the knowledge gathered in RESTORE4Cs on restoring coastal wetlands.

In two further sections, the roadmap underlines the importance of:

- a good governance structure and stakeholder participation to support coastal wetland restoration, focusing on key stakeholders and their roles and strategies for involving local communities and stakeholders
- enabling capacities and increasing awareness

Each thematic block of the roadmap is elaborated in more detailed steps which outline the main results, methods or tools from RESTORE4Cs which can be used to support authorities and practitioners in the specific step of the process.

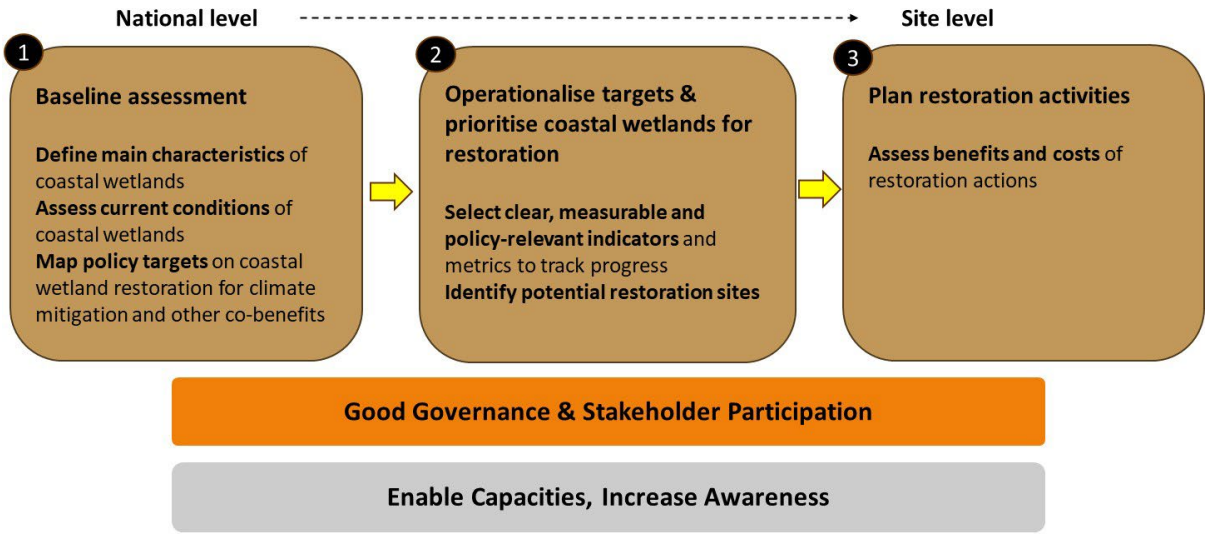
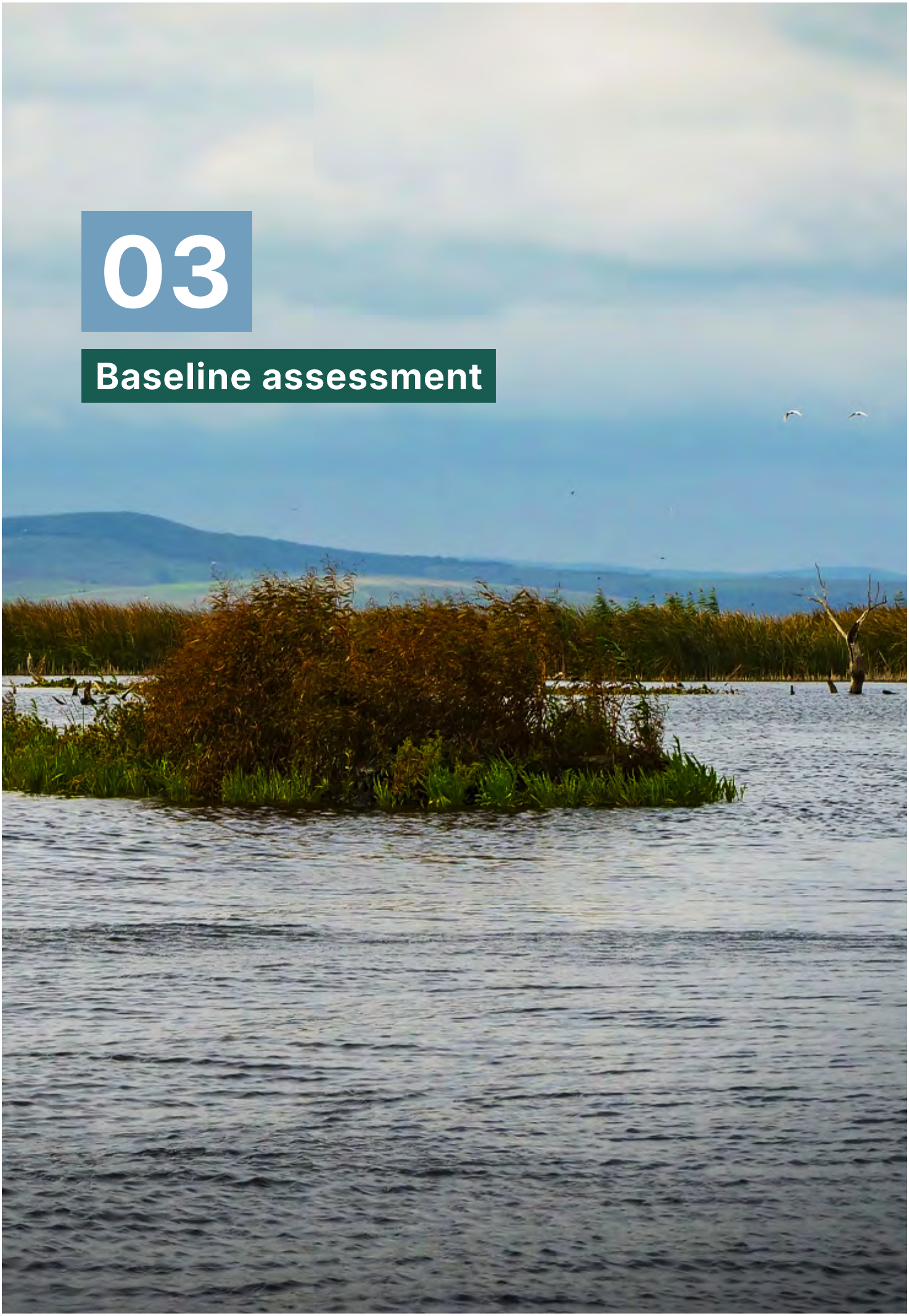


Figure 1: Structure of pilot roadmap for Romania.

03

Baseline assessment



3. Baseline assessment

Define main characteristics of coastal wetlands

- → **Determine whether a definition of coastal wetlands exists within the national policy framework and identify if improvements are needed.**
- → **Establish the criteria for delimiting coastal areas for baseline assessment and mapping activities.**
- → **Identify the current extent of coastal wetlands and describe the habitat types present.**

According to data from 2022, wetlands occupied around 5% of Romania's territory, covering approximately 1,1 million ha[7]. Most of Romania's wetlands are inland freshwater wetlands, including marshes, peat bogs, and floodplains along major rivers like the Danube. However, Romania also has significant coastal wetlands along the Black Sea shoreline. Coastal wetlands in Romania are predominantly located in the Danube Delta with the Danube Delta Biosphere Reserve as the dominant system, representing one of Europe's largest coastal wetland complexes. Additional important wetlands include the Razim–Sinoe lagoon system and several coastal lakes along the Black Sea shoreline (e.g., Techirghiol, Nuntași, Tasaul). These wetlands represent transitional environments between freshwater systems (e.g., Danube tributaries) and marine environments (e.g., Black Sea and its coastal lagoons), shaped by fluvial dynamics, saline intrusion, and seasonal water-level fluctuations rather than true tidal processes, as the Black Sea is microtidal.

Wetland habitat types comprise freshwater and brackish marshes, extensive reedbeds, saline and brackish lagoons, mudflats, coastal wet meadows and grasslands, dune-marsh complexes, and shallow marine vegetated areas. More specifically, the main habitat types include:

- **Freshwater marshes** and **reedbeds** (extensive in the Danube Delta)
- **Brackish and saline lagoons** (Razim, Sinoe, Zmeica, Golovița)
- **Salt marshes** and **coastal wet meadows** (often seasonal and low-lying)
- **Mud flats and sandbanks** (limited presence, mostly in deltaic outflows)
- **Aquatic vegetation zones**, including submerged macrophytes
- **Artificial or semi-natural wetlands**, such as fishponds and drainage canals, which retain ecological value

These wetlands are influenced by a mix of freshwater inflows (from the Danube and its tributaries) and brackish conditions from the Black Sea, which has an average salinity of around 17-18 PSU. This mix creates saline and brackish environments in coastal lagoons and deltaic areas. The ecosystem structure is shaped by seasonal water level fluctuations, sediment dynamics, and land-use changes. Coastal wetlands provide key ecosystem services including flood buffering, biodiversity habitat, nutrient cycling, and carbon storage.

While **no precise national inventory** or official classification exists for "coastal wetlands" in Romania, the largest and most prominent area is the **Danube Delta Biosphere Reserve**, covering approximately

7 Kampa, E. et al. (2024). Policy analysis and policy demands for data, methods, and tools (Part A). Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

580,000 ha total surface, of which over **400,000 ha** includes wetland habitats (both coastal and inland types). The **Razim-Sinoe lagoon complex** adds another significant area (estimated **~100,000 ha**, depending on classification criteria). Altogether, coastal wetlands in Romania likely exceed **500,000 ha** in extent, an official delineation is lacking, and the term "coastal wetland" is **not consistently defined in national policy** documents[8,9].

The lack of **an official national definition** of coastal wetlands creates inconsistencies in management, monitoring, and restoration planning. Different national policies refer to wetlands broadly, without distinguishing between inland and coastal systems.

Furthermore, according to estimates of the Danube Delta Biosphere Reserve Administration, less than 10% of the country's coastal wetland area is currently protected under the Romanian Water Law and the Government Emergency Ordinance on the regime of protected natural areas, conservation of natural habitats, wild flora and fauna[10.] Most of the protected coastal wetlands is public property[11].

In practice, conservation and restoration efforts in Romania are strongly focused on the Danube Delta, which benefits from a dedicated administrative authority, long-term management planning, and sustained access to national and EU funding. By contrast, smaller coastal wetlands outside the Delta, such as lagoons, coastal lakes, marshes, and transitional wetland systems along the Black Sea coast, are often addressed only through broad designation frameworks, with limited site-specific planning, monitoring, or restoration investment. As a result, these wetlands are formally recognised but remain underrepresented in strategic conservation and restoration initiatives[12]. These ecosystems are recognised under Natura 2000, the Ramsar Convention, and several national protected area designations, but coverage remains incomplete.

Support from RESTORE4Cs

A more precise and improved definition of coastal wetlands in Romania can be adapted from the Ramsar Convention and the EU NRR, as follows: *Coastal wetlands are wetland ecosystems located within Romania's coastal and deltaic zones, influenced by the interactions between the Black Sea marine environment and the freshwater systems of the Danube and its distributaries. They include freshwater, brackish, and saline habitats such as lagoons, marshes, reedbeds, tidal flats, sandbanks, coastal meadows, salt marshes, and shallow marine waters up to 6 m depth.*

Moreover, based on the definition by RAMSAR combined with CORINE Land Cover data and supported by the Ramsar Wetland Inventory and the Natura 2000 database, the Extent and Condition Indicators Tool developed by RESTORE4Cs in the European Coastal Wetlands Interactive Platform provides a national summary and visualisation of coastal wetlands in Romania, including coastal wetlands extent, distribution of habitat types (e.g., saltmarsh, lagoon, seagrass, tidal flat) (Figure 2 and Table 2), and wetland area under protection in nationally designated protected areas (Figure 4 in the next section).

8 Török, Z. (2002). The Romanian wetland inventory project. Scientific Annals 9, 161-173.

9 Gâștescu, P. & Știucă, R. (2008). Delta Dunării. Rezervație a Biosferei, Edit. CDPress, București.

10 DDBRA. (2025). Functional Zoning. DDBRA. Available at: https://ddbra.ro/zonare-functionala.

11 Ibid.

12 European Commission & Ministry of Environment (Romania). (2019). Prioritised action framework for the Natura 2000 network in Romania 2021-2027. Available at: https://www.mmediu.ro/app/webroot/uploads/files/RO%20PAF.pdf.

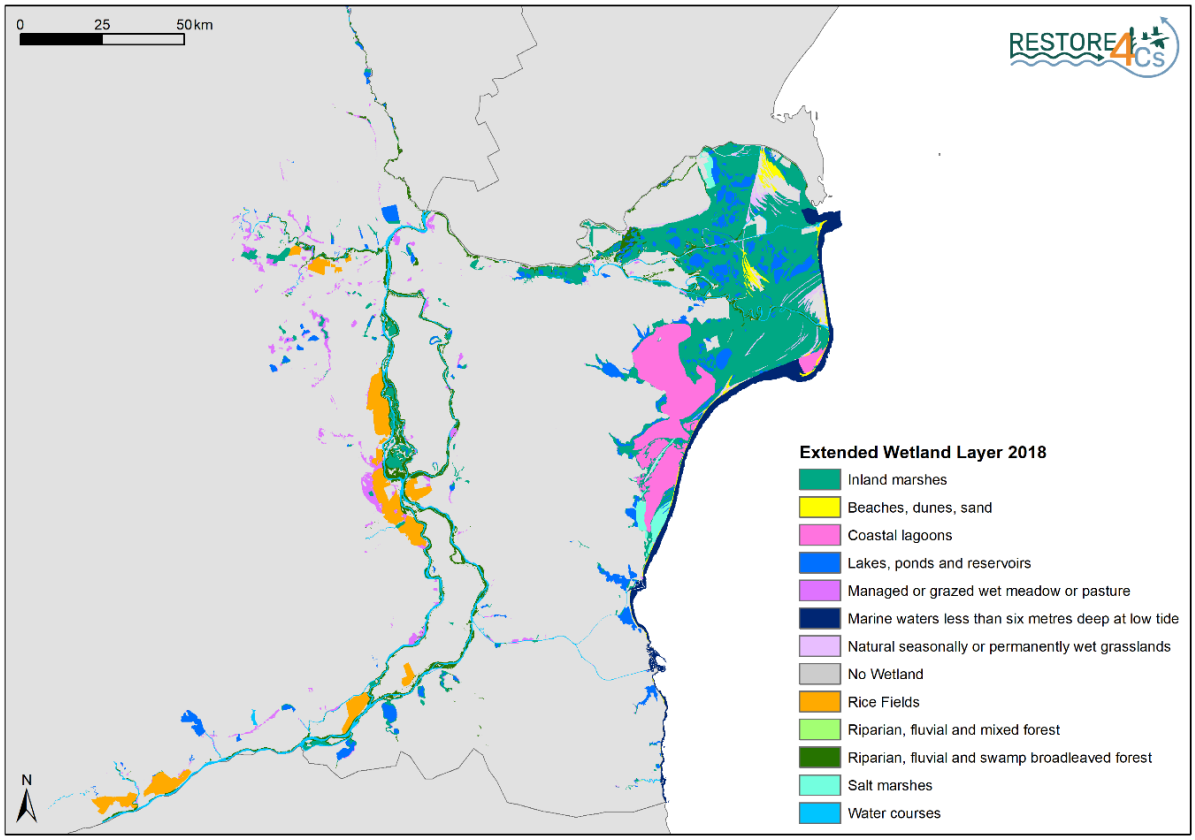


Figure 2: Map on extent of coastal wetlands in Romania. Source: Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform (based on extended Wetland Layer).

Table 2: Coastal wetland extent in Romania (2018).

Coastal Wetland Habitat Type	Area (km²)
Rice Fields	448,10
Riparian, fluvial and swamp broadleaved forest	480,52
Riparian, fluvial and mixed forest	0,47
Managed or grazed wet meadow or pasture	273,39
Natural seasonally or permanently wet grasslands	95,04
Beaches, dunes, sand[13]	89,84
Inland marshes	2372,13
Salt marshes	88,60
Coastal lagoons	694,21
Water courses	351,87
Lakes, ponds and reservoirs	647,89
Marine waters less than six metres deep at low tide	340,20

Source: Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform.

13 Beaches, dunes, and sand formations are generally not considered wetlands under the Ramsar Convention. Their inclusion here reflects their ecological connection to coastal wetland systems, as they often form part of transitional zones that influence hydrology, sediment dynamics, and habitat connectivity. However, they do not typically meet the hydrological criteria for wetlands.

The map in Figure 2 illustrates the spatial distribution and diversity of coastal wetlands in Romania, with a clear concentration along the Danube Delta and the Black Sea coastline. The Danube Delta appears as the largest and most complex wetland system, characterised by an extensive mosaic of habitat types, including **inland marshes (dark green)**, **coastal lagoons (pink)**, **salt marshes (light blue)**, **riparian forests (various greens)**, and **shallow marine waters (dark blue)**. These habitats reflect the strong interaction between riverine, lagoonal, and marine transition processes.

South of the Delta, the coastline includes smaller but ecologically important wetland areas, such as dune systems (yellow), lakes and ponds (blue), and patches of natural wet grasslands (light purple). The Razim-Sinoe lagoon complex is clearly visible as a large area dominated by coastal lagoons and wet grassland habitats, showing its role as a major brackish wetland region.

Inland extensions of the Delta system, following the Danube and its distributaries, are riparian marshes, meadows, and floodplain forests that form ecological corridors linking inland wetlands to the coastal zone.

Overall, **Romania's coastal wetlands are extensive, diverse, and primarily clustered in the Danube Delta and Razim-Sinoe areas**, with smaller wetland fragments distributed along the southern Black Sea coast. This spatial pattern confirms the ecological significance of the Danube Delta as the core of Romania's coastal wetland network and underscores the need for targeted passive or active restoration actions and integrated management of these interconnected habitats.

Assess current conditions of coastal wetlands

- → **Determine the overall status of coastal wetlands.**
- → **Identify the area of coastal wetlands that is currently under protection.**
- → **Describe the main threats and pressures affecting coastal wetlands.**
- → **Verify whether a classification system exists for coastal wetlands based on their health condition.**

Romania's coastal wetlands, centred in the Danube Delta and Razim-Sinoe lagoon system, are ecologically vital transition zones between freshwater and marine environments. These wetlands support biodiversity, water regulation, and carbon storage but face significant degradation. This section provides the current status, vulnerabilities, and knowledge gaps on coastal wetlands conditions.

While protected areas along the Romanian coast, most notably the Danube Delta Biosphere Reserve, generally maintain relatively good ecological conditions, the status of coastal wetlands outside this core area is more variable, with site-specific information on smaller coastal wetlands remaining limited. Moreover, available assessments indicate that **several coastal wetland systems are subject to ongoing pressures, including eutrophication, hydrological alteration, land-use change, and climate- or hydrology-driven salinisation and drought,** which can lead to local degradation even within designated protected areas[14,15].

Salinisation occurs when reduced freshwater inflows allow brackish water from the Black Sea to intrude into lagoons and deltaic zones, altering habitat conditions. The Danube Delta remains the healthiest coastal wetland system but faces cumulative stressors. In contrast, the Razim-Sinoe complex shows signs of declining biodiversity, increased sedimentation, and partial habitat loss[16,17,18].

There is currently no national estimate for the area of coastal wetlands covered by Annex I (terrestrial ecosystems e.g., coastal lagoons, salt marshes, dune-marsh complexes) or Annex II (marine ecosystems, e.g. shallow marine waters, submerged macrophyte beds) of the EU NRR that are in 'not good' condition. This reflects Romania's **lack of a national wetland classification system aligned with EU NRR definitions**.

14 Ciobotaru, N. et al. (2016). Mapping Romanian wetlands – A geographical analysis. 3rd International Conference Water resources and wetlands 3. 220-227. Available at: https://www.researchgate.net/publication/305277994_MAPPING_ROMANIAN_WETLANDS_-_A_GEOGRAPHICAL_APPROACH.

15 Matei, M. et al. (2016). Assessment of pressures caused by climate change on wetlands in Romania based on the MAES framework.

16 Seceleanu-Odor, D. et al. (2018). Time evolution of water quality parameters in the Razim-Sinoe aquatic complex (Romania) 1991–2017. In Deltas and Wetlands Book of Abstracts. Danube Delta National Institute for Research and Development.

17 European Commission & Ministry of Environment (Romania). (2019). Prioritised action framework for the Natura 2000 network in Romania 2021–2027. https://www.mmediu.ro/app/webroot/uploads/files/RO%20PAF.pdf.

18 DDBRA. (n.d.). Despre rezervatie. DDBRA. Available at: https://ddbra.ro/prezentare-generala/.

Support from RESTORE4Cs

Water scarcity is a critical stressor in the Danube Delta because reduced freshwater inflows disrupt hydrological balance, degrade wetland habitats, and threaten the biodiversity and ecosystem services that depend on stable water levels. Further, **the Danube Delta is increasingly affected by climate change, resulting in droughts and very low levels of water** which pose significant challenges to ecosystems, water availability to sustain biodiversity and restoration efforts. The map in Figure 3 produced in RESTORE4Cs project illustrates the spatial variability of surface water dynamics across Romania's coastal wetlands, with darker blue areas indicating sites that experience frequent or persistent flooding. These zones of high water mobility correspond to the most hydrologically active wetland habitats, such as lakes, lagoon edges, and river channels, which play a critical role in sustaining ecological functions. Stable and dynamic surface water areas are essential for maintaining wetland biodiversity, particularly for waterbirds that depend on shallow, fluctuating waters for feeding, breeding, and migration stopovers. In addition, these hydrologically active wetlands provide key ecosystem services, including water purification, nutrient retention, and natural flood buffering, making the understanding of surface water dynamics crucial for effective conservation and restoration planning.

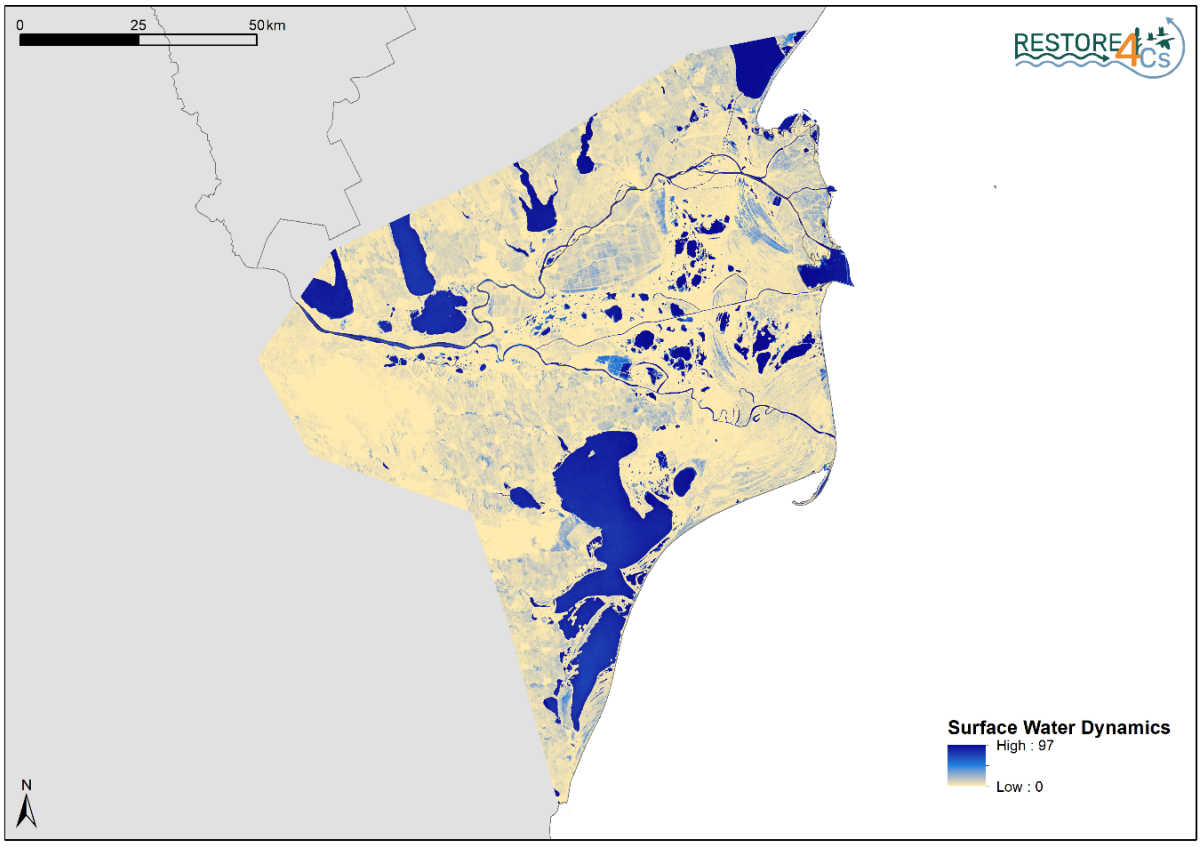


Figure 3: Surface water dynamics extracted from satellite imagery 2022-2024 (values show the occurrence of inundation in a pixel over a given period, where 100% refers to a permanent water body, and medium to high values indicate areas with temporal water coverage). Source: University of Malaga.

The map in Figure 4 shows that **only a small share of Romania's coastal wetlands falls within nationally designated protected areas** (highlighted in green), while **most of the coastal wetland extent, especially across the Danube Delta and the Razim-Sinoe lagoon system, lies in areas lacking adequate legal protection** (shown in red). This illustrates a **significant protection gap**, where ecologically valuable wetland habitats remain outside strong national conservation frameworks. National monitoring of wetland health remains fragmented and lacks a unified typology. **Romania**

lacks a national system for monitoring wetland health, classifying the condition of coastal wetland habitats, and mapping restoration potential. Support can be provided by the RESTORE4Cs Indicators Tool on the European Coastal Wetlands Interactive Platform which provides information on coastal wetlands conditions and direct drivers of land use change, climate change, pollution, water exploitation and invasive alien species, based on latest available EU data (see Table 3).

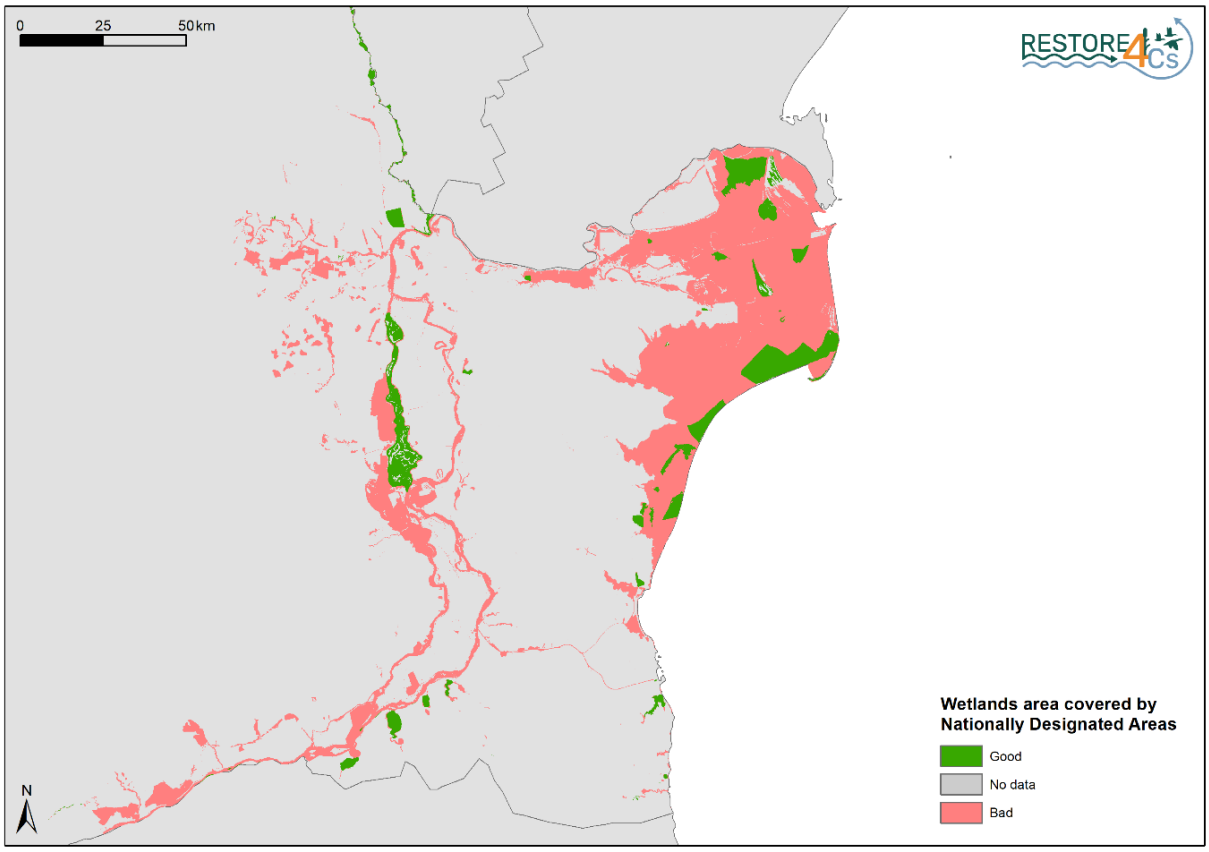


Figure 4: Coastal wetlands area covered by Nationally Designated protected areas (Green colour (Good)=Wetland protected by national designated areas; Red colour (Bad)=Wetland not protected by national designated areas). Source: Extent and Condition Indicators Tool on the European Coastal Wetlands Interactive Platform.

Romania also lacks comprehensive national data on the carbon storage or GHG emissions from its coastal wetlands. Although wetlands are acknowledged as key adaptation measures in national climate strategies, **no quantified assessments have been conducted to date on carbon stocks, GHG (CH_4/CO_2) fluxes, or mitigation benefits from restoration efforts**. Emission reductions and restoration gains from coastal wetland management are neither monitored nor reported. Further, coastal wetlands are not yet included in LULUCF reporting, which until 2025 has focused primarily on forests, cropland, and inland wetlands. As a result, the GHG fluxes and carbon sequestration potential of coastal wetlands remain unaccounted for.

Table 3: Conditions and Drivers indicators available in the Indicators Tool on the European Coastal Wetlands Interactive Platform.

Ecosystem condition	Direct drivers
• Physical state (including soil moisture deficit during the vegetation growing season, and sea water salinity) • Chemical state (including percentage of samples classified as "good" or "excellent" state of bathing water) • Compositional state (including percentage of wetland species with good population status, richness of wetland species, and percentage of wetland birds with increasing or stable population trends) • Structural state (including annual mean Normalised Difference Vegetation Index (NDVI), and water occurrence decrease intensity) • Landscape and seascape (including connectivity, and fragmentation)	• Land-use change (including the percentage of wetland area covered by nationally designated areas and Natura 2000, the extent of agricultural area around wetlands (see Figure 6 as an example), and the imperviousness of the local drainage basin), • Climate change (including drought event frequency, extreme drought frequency, trends in sea level, and surface air temperature anomalies), • Pollution (including exceedance of critical loads for eutrophication and non-atmospheric nitrogen inputs to soil), • Direct exploitation (water exploitation index (WEI+)), and • Invasive alien species.

Map policy targets for coastal wetland restoration for climate change mitigation and other co-benefits

- → **Identify relevant national policies that address the restoration and conservation of coastal wetlands and specify any embedded restoration targets.**
- → **Assess the degree of alignment between national policy targets and EU/global commitments on wetland restoration and climate mitigation.**
- → **Evaluate opportunities to operationalise higher-level policy targets into actionable measures that support coastal wetland restoration.**

With the Danube Delta as a major European coastal wetland, several national policies exist in Romania that are relevant to coastal wetland restoration and conservation. However, Romania does not currently have a dedicated national wetland strategy as a standalone policy. Instead, wetland conservation and restoration objectives are embedded within broader national strategies and action plans, presented below.

Support from RESTORE4Cs

Nature and Biodiversity

The **Romanian National Strategy and Action plan for Biodiversity Conservation 2014-2020 (NBASP)**[19] aims to ensure the coherence and efficient management of the national network of protected areas, including wetlands of international importance as defined under the Ramsar Convention. One of the major objectives of the National Strategy is the maintenance and restoration of ecosystems and their services through the creation of green infrastructures and **the restoration of at least 15% of degraded ecosystems**. The plan encourages, *i.a.*, the development and implementation of policies for biodiversity-rich areas which are, however, located outside protected natural areas, including wetlands. Wetlands are mentioned in the Strategy in the context of their importance for the migration and dispersion of wild species as well as for ensuring connectivity between populations of the same species. **The NBASP explicitly aims to support the management of both Natura 2000 and Ramsar sites.**

The **National Sustainable Development Strategy 2030 (2018)**[20] integrates environmental considerations into broader socio-economic planning, emphasising the sustainable use of natural resources and the importance of ecosystem services provided by wetlands. Two of its targets are directly related to wetlands:

- "**Develop green infrastructure** and make use of the services offered by natural ecosystems (in particular the Danube floodplains, its tributaries and the Danube Delta) **through** the integrated management of river basins and **wetlands**."
- "**Conserve and protect wetland areas**, which also include the Danube Delta Biosphere Reserve, a unique wetland in Romania and part of European and world natural heritage."

19 Government Decision 1081/2013 of December 11, 2013, introducing National Strategy and Action Plan for Biodiversity Conservation 2014-2020. Available at: https://faolex.fao.org/docs/pdf/rom203463.pdf.

20 Government Decision 877/2018 of November 9, 2018, introducing Romania´s Sustainable Development Strategy 2030. Available at: https://faolex.fao.org/docs/pdf/rom195029.pdf.

Wetlands are also addressed under other sectoral strategies, such as **the Territorial Development Strategy of Romania 2035 (2016)** which highlight that "developing green infrastructure, avoiding landscape fragmentation and reducing the impact of fragmentation through ecological networks, especially Natura 2000, is key to maintaining a sustainable environment". Through promoting green infrastructure, inter alia as a climate adaption measure, the policy lays the basis for wetland restoration efforts.

The **Large Infrastructure Operational Programme** aimed at promoting sustainable economic growth while ensuring safe and efficient use of natural resources. It allocated funding for restoration of ecosystems (e.g., stream and lacustrine ones), coastal erosion and flood risk management, biodiversity protection, which may include measures on wetland restoration.

The **Government Emergency Ordinance on the regime of protected natural areas, conservation of natural habitats, wild flora and fauna (2007)**[21] aims to maintain or restore natural habitats and species of wild flora and fauna to a favourable conservation status (Art. 2). The Ordinance specifically emphasises the need to ensure appropriate protection, conservation and use of the most representative natural habitats within Romania´s biogeographical space. These cover areas with specific biological floristic and faunal diversity, including marine, littoral, and coastal areas, plain, hill and mountain, wetlands, arid and ecotone areas, watercourses with meadow areas and natural lakes. As such, the Ordinance provides an important framework for fulfilling Romania's obligations under the EU Nature Directives.

Law 5/2000 (2000)[22] and **Decision HG 1.581/2005 (2005)**[23] provide the legal framework for **protecting Romania´s natural heritage**. The law defines protected areas as natural or built areas, delimited geographically and/or topographically, which include natural and/or cultural heritage values and are declared as such to achieve the specific objectives of conservation of heritage values. It establishes the types of protected areas designations located both inside and outside the Danube Delta Biosphere Reserve. The primary objective of these protected areas is the conservation of marine biodiversity. Additionally, the framework seeks to eliminate and prevent activities involving the exploitation or use of resources that conflict with conservation goals, while also supporting conditions for scientific research, education, and recreation. In certain sub-areas of these protected areas, traditional, permanent, or temporary activities are allowed.

Water, marine, and coastal protection

In the field of water management, a central piece of legislation is **the Water Law (1996)**[24], which provides the general framework for the exploitation, conservation, and protection of water resources. The law mandates the development of planning and management frameworks for individual basins or groups of hydrographic basins, with the goal of achieving sustainable management of water resources, aquatic ecosystems, and wetlands. Two main planning instruments are foreseen: the Hydrographic Basin Development Plan and **the Hydrographic Basin Management Plan**. Both instruments establish measures for **wetland restoration and conservation.**

21 Ordinance No. 57/2007 of June 20, 2007, Official Gazette No. 442 of June 29, 2007. Available at: https://legislatie.just.ro/Public/DetaliiDocument/83289.

22 Law No. 5/2000 of March 6, 2000. https://legislatie.just.ro/Public/DetaliiDocument/21860.

23 Decision No. 1581 of December 8, 2005, Official Gazette No. 24 of January 11, 2006. https://legislatie.just.ro/Public/DetaliiDocument/67794.

24 Law No. 107/1996 of September 25, 1996, Official Gazette No. 244, October 8, 1996. https://legislatie.just.ro/Public/DetaliiDocumentAfis/8565.

In the marine policy field, two laws are of particular relevance. **Law no. 98 /1992 (1992)**[25] ratifies the **Convention on the Protection of the Black Sea against Pollution**. It aims at the reduction of pollution from rivers, as well as the conservation of biodiversity and the expansion of protected territories. In addition, **Law no. 158/2014 (2014)**[26] ratifies the **Protocol on the Protection of the Marine Environment of the Black Sea against Pollution from Land-Based Sources and Activities.** Both acts establish conditions to prevent environmental degradation, affecting, *i.a*., coastal wetlands.

In addition, the **Integrated Sustainable Development Strategy of the Danube Delta**[27], adopted in 2016, provides an overarching strategic framework for balancing environmental protection with socio-economic development in the Danube Delta region. The Strategy recognises the Danube Delta as a unique natural asset of European and global importance and explicitly highlights the role of wetlands in supporting biodiversity conservation, climate resilience, water regulation, and sustainable livelihoods. It promotes an integrated, place-based approach that combines ecosystem restoration, sustainable use of natural resources, and improved quality of life for local communities. Wetland restoration and the maintenance of natural hydrological processes are identified as key priorities to reduce vulnerability to climate change, support fisheries and eco-tourism, and enhance ecosystem services. The Strategy also emphasises participatory governance, cross-sectoral coordination, and alignment with EU environmental and regional development policies, thereby providing an important policy foundation for coastal wetland restoration initiatives in the Danube Delta.

Climate change mitigation and adaptation

The **Integrated National Energy and Climate Change Plan (NECP) 2025-2030 Update (2024)**[28] sets out Romania's national goals and objectives in line with EU targets and the Paris Agreement. To achieve national GHG reduction targets and combat climate change, the policy proposes several sectoral measures. Unlike the 2021 edition of the Plan which proposed "protecting, **restoring** and ensuring sustainable use **of Natura 2000 sites**", the current document does not refer to wetland or ecosystem restoration as part of the decarbonisation and climate resilience measures.

The **National Strategy on Adaptation to Climate Change 2024-2030**[29] **(2024)** aims to improve the adaptive capacity and increase resilience of socio-economic and natural systems to the impacts of climate variability across sectors. The most relevant strategic objectives focus on:

- Reducing the risk of scarcity regarding water resources (OS.1.1);
- Supporting **the conservation, restoration** and strengthening of the **continuity of habitats and ecological networks, relying on green-blue infrastructure** and afro-ecological infrastructure (OS.3.2);

25 Law No. 98/1992 of September 16, 1992, Official Gazette No. 242, September 29, 1992. https://legislatie.just.ro/Public/DetaliiDocumentAfis/2372.

26 Law No. 158/2014 of December 3, 2014, Official Gazette No. 894, December 9, 2014. https://legislatie.just.ro/Public/DetaliiDocument/163678.

27 Romania´s Ministry of Regional Development and Public Administration. (2016). Integrated Sustainable Development Strategy for the Danube Delta. Ministry of Regional Development and Public Administration. Available at: https://www.mdlpa.ro/uploads/articole/attachments/5dc54f4615388605628193.pdf.

28 European Commission. (2024). Romania – Final Updated NECP 2021-2030 (submitted in 2024). European Commission. https://commission.europa.eu/document/download/75df0ac2-ecf9-4212-89ac-2a603bd43e36_en?filename=RO_FINAL%20UPDATED%20NECP%202021-2030%20%28English%29.pdf.

29 Decision No. 529 of July 24, 2013, Official Gazette No. 536, August 28, 2013. https://faolex.fao.org/docs/pdf/rom202404.pdf.

- Supporting/promoting the use of best practices in sustainable and climate-smart agriculture, aquaculture and forest management (OS.3.3);
- Supporting the development of a coherent, connected and representative network of protected areas and strictly protected areas implementing adaptive management (OS.3.4);
- Integrating ecosystem resilience issue into all relevant public policies and sectoral patterns of economic activities (OS.3.5).

Also, the National Strategy and its corresponding Action Plan encourage the restoration and recovery of areas with a potential for carbon storage, such as forest ecosystems and wetlands, and include specific measures, such as: avoiding afforestation of wetlands and peatlands (P.3.3.5); protecting organic matter in the soil, especially carbon-rich soils, such as marshes, peatlands, etc., **restoring marshes and peatlands** and carbon in degraded soils with high risk of erosion or desertification (P.8.2.1.). Additionally, the Action Plan promotes measures, including financial ones, to support the increase in carbon sequestration on agricultural land (M.8.1.1.2), including by maintaining wetlands and peatlands.

Table 4 gives an overview of Romanian policy targets and objectives with the highest relevance for coastal wetland restoration.

Table 4: Overview of the most wetland-relevant policy targets and objectives and their connection to EU and/or global policies.

Policy	Targets (objectives)	Link to EU or Global Policy
Nature and Biodiversity		
National Strategy and Action Plan for Biodiversity Conservation 2014–2020 (NBASP)	- Maintain and restore ecosystems and their services - Restore at least 15% of degraded ecosystems - Support Natura 2000 and Ramsar sites	- EU Biodiversity Strategy for 2020 - Ramsar Convention
National Sustainable Development Strategy	- Develop green infrastructure - Conserve and protect wetland areas (e.g., Danube Delta Biosphere Reserve) - Integrate wetland ecosystem services into planning	- UN Sustainable Development Goals (SDGs)
Large Infrastructure Operational Programme	- Maintain and restore degraded ecosystems and the services provided located outside protected natural areas, including lacustrine and stream ecosystems	- EU Cohesion Policy - EU Biodiversity Strategy
Government Emergency Ordinance on Protected Natural Areas	- Restore and maintain natural habitats including wetlands - Ensure protection and sustainable use of diverse habitats	- EU Habitats and Birds Directives (Nature Directives) - Natura 2000
Law No. 5/2000 & Decision HG 1581/2005	- Conserve marine biodiversity - Restrict harmful resource use	- Natura 2000 - EU environmental protection framework

Water, marine and coastal protection		
Water Law	- Sustainably manage water resources and wetlands - Implement Hydrographic Basin Development and Management Plans including wetland restoration	- EU WFD - EU Biodiversity Strategy
Law No. 98/1992 (Black Sea Protection Convention)	- Reduce river-based pollution - Expand protected areas - Conserve coastal biodiversity	- Convention on the Protection of the Black Sea Against Pollution
Law No. 158/2014 (Black Sea Protocol)	- Prevent land-based pollution of marine and coastal ecosystems (with Danube Delta specifications)	- Protocol on the Protection of the Marine Environment of the Black Sea Against Pollution
Integrated Sustainable Development Strategy of the Danube Delta (SIDDD)	- Wetland restoration and the maintenance of natural hydrological processes are key priorities for reducing vulnerability to climate change, support fisheries and eco-tourism, and enhance ecosystem services	- Ramsar Convention
Climate change mitigation and adaptation		
National Strategy on Adaptation to Climate Change 2024–2030	- Supporting the conservation, restoration and strengthening of the continuity of habitats and ecological networks, relying on green-blue infrastructure and afro-ecological infrastructure - Supporting the development of a coherent, connected and representative network of protected areas and strictly protected areas implementing adaptive management - Protecting organic matter in the soil, especially carbon-rich soils, such as marshes, peatlands, etc., restoring marshes and peatlands and restoring carbon in degraded - Supporting the increase in carbon sequestration on agricultural land, including by maintaining wetlands and peatlands.	- UNFCCC, Paris Agreement

Conclusions

→ There is **no national wetland strategy** covering all types of wetland ecosystems. The existing national policy framework primarily focuses on the Danube Delta, Romania's largest and most prominent wetland. As a result, smaller wetland areas may be overlooked or insufficiently addressed. In addition, there is no formal definition of coastal wetlands at the national level. This gap creates uncertainty regarding the scope and applicability of proposed wetland-related measures for wetlands on coastal and marine transition habitats.

→ Some policies contain coastal wetland-related targets that are aligned with relevant EU and global targets. However, they mainly remain high-level, generic and often outdated. There is the **need to align national targets more strongly with recent developments at EU level, in particular with those under the EU NRR**. The target of restoring at least 15% of degraded ecosystems set in the National Strategy and Action plan for Biodiversity Conservation 2014–2020 remains below the target of restoring at least 20% of the EU's land and sea ecosystems by 2030, and ultimately all ecosystems in need of restoration by 2050 defined in the EU NRR.

→ While Romania does not yet have a dedicated national wetland strategy, the EU NRR requires the **development of a National Restoration Plan by 2026**, which will likely trigger updates to Romania's biodiversity and climate strategies.

→ Implementing **obligations under the EU NRR to restore a specific percentage of wetlands** is an opportunity that can significantly improve coastal restoration efforts. This should be combined with other priority policy efforts in particular implementing a policy of delineation and accounting of coastal wetlands under different levels of threat for restoration efforts to be better targeted, prioritised, and managed.

→ Additionally, the **National Climate Adaptation Strategy (2024-2030) is expected to further institutionalise the role of wetland restoration** in adaptation planning.

→ **Benefits of coastal wetland restoration should be more explicitly recognised in national legislation**, particularly in relation to climate mitigation and adaptation. Currently, the focus is placed on wetlands in general, with a strong emphasis on their connection to agricultural activities, while the climate-related potential and benefits of coastal wetlands are not directly addressed. Acknowledging their climate regulation functions would help ensure their protection and support prioritising their restoration in national programmes.

Key recommendations

To address current data gaps and strengthen climate and restoration planning for coastal wetlands in Romania, the following actions are recommended:

→ Adopt a **consistent definition of wetlands**, including coastal wetlands, in national policies to eliminate inconsistencies in management, monitoring and restoration planning.

→ Develop a **national wetland strategy** to create a legal and policy framework for restoration and conservation.

→ Establish a **coastal wetland typology** aligned with Annex I/II definitions of the EU NRR.

→ Develop a national system for wetland health condition assessments and restoration planning.

→ Define **restoration targets for coastal and freshwater wetlands** under the EU NRR, including reporting and monitoring indicators.

→ Continue building **GHG fluxes and carbon storage studies** to quantify climate mitigation potential from restoration and conservation actions.

→ Integrate **coastal wetlands into future LULUCF reporting** and restoration planning.

04

Operationalise targets and prioritise

4. Operationalise targets and prioritise

Select clear, measurable and policy-relevant indicators and metrics to track progress of coastal wetland restoration and its impact on climate mitigation

→ **Identify indicators suitable for assessing changes in the status of coastal wetlands over time and for monitoring progress toward key policy targets.**

→ **Determine approaches to operationalise policy-related metrics and indices, including methods for mapping them at different scales using spatial indicators and data layers.**

To effectively operationalise coastal wetland-relevant policy targets, it is necessary to:

- **Use clear, measurable indicators and metrics** to accurately assess the baseline of wetland ecological status and resilience. These indicators must also assess changes in the status of coastal wetlands over time and answer what is required to be monitored to track progress and measure it against national, EU and international commitments and targets for climate and biodiversity.
- **Integrate advanced technologies** like remote sensing, GIS, data analytics, and machine learning with in-situ measures which enhances the ability to monitor trends, assess interventions, and support evidence-based decisions for sustainable wetland management and restoration.

In this context, it is important to balance the need for robust indicators providing clear evidence of the contribution of coastal wetland restoration efforts to various policy objectives without creating more administrative complexity.

In Romania, there is lack of standardised and uniform indicators at national level to assess changes in wetland status over time and monitor progress against key policy targets. Existing monitoring focuses mainly on **water status** (e.g., chemical and ecological quality) and **Natura 2000 reporting**. However, key dimensions needed for restoration planning, such as **wetland extent and condition**, **GHG fluxes**, **hydrological connectivity**, **soil moisture trends**, and **pressure indicators** (e.g., land-use change, invasive species), are not monitored consistently at national level.

Support from RESTORE4Cs

RESTORE4Cs proposes eight policy outcome indicators to evaluate the status, trends, and targets for coastal wetlands in alignment with EU policies (Table 5). The description of each indicator also outlines how it links to existing policies such as the Habitats Directive, the WFD, and EU NRR as well as international agreements.

The results of these indicators can be filtered and displayed for Romania in the Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform.

The goal is to use already available data sources to provide information on these indicators, including in-situ and remote sensing data. The use of the proposed indicators should not create additional burden to competent authorities but help provide the evidence needed on the contribution of coastal wetlands restoration efforts to various policy targets.

An example of indicator application for Romania is illustrated in Table 6, according to which only 0.05% of Romanian coastal wetlands are in strict protection but up to 65% are designated as Ramsar and in Natura 2000 sites.

Table 5: Policy outcome indicators and metrics proposed by RESTORE4Cs to build evidence and foster greater integration between national and EU policies to streamline reporting processes. Indicators can be disaggregated per country and EU level.

Policy Indicator Output	Metric title	Units	Description
Extension of Coastal Wetlands Protected and Strictly Protected 	Total Coastal Wetland Extent in Protected Areas and in Strict Protected Areas	Area Coverage (km²)	Percentage change on spatial cover of total coastal wetlands protected and strictly protected from total protected areas.
	Total Coastal Wetland Extent in Natura 2000 sites	Area Coverage (km²)	Extent of coastal wetlands within the Natura 2000 network.
	Total Coastal Wetland Extent designated as Ramsar and/in Natura 2000	Area Coverage (km²)	Total area of coastal wetlands designated as Ramsar sites within the Natura 2000 network.
	Total Coastal Wetland Protected as a Proportion of Coastal Wetlands	Percentage of area coverage (km²)	Extent of coastal wetlands protected within designated areas as a percentage of the total coastal wetland extent. It offers a measure of the overall conservation coverage of coastal wetlands.
Representativity of Coastal Wetland Habitats in Protected Areas 	Spatial Cover of Different Coastal Wetland Habitats in Protected Areas	Percentage of area coverage (km²)	Coastal wetland extent data by habitat type (e.g., salt marshes, mudflats).
	Individual Coastal Wetland Habitat Extent in Natura 2000	Area Coverage (km²)	Specific coastal wetland habitat types within the Natura 2000 network.
Improved Coastal Wetland Health 	Coastal Wetland Knowledge	Proportion of data available where habitat condition is known.	Measures the extent of knowledge available regarding the habitat condition of coastal wetlands, as outlined in Annex I of the NRR.
	Coastal Wetland Habitat Condition	Percentage change in good condition of different coastal wetland habitats	Measures changes in the quality of various coastal wetland habitats (Annex I of Habitats Directive and those in Annexes I, II, IV and V of the Habitats Directive and the EU NRR) over time and per each biogeographic region. It includes factors such as vegetation health, soil quality, and water clarity.
	Coastal Wetland Biodiversity (Species) Condition	Percentage change in good condition of different coastal wetland species	Tracks changes in the condition of species diversity and abundance (referred to in Annexes II, IV and Vto Directive 92/43/EEC and of the species covered by Directive 2009/147/EC.) within different coastal wetland habitats.
	Deterioration Status	Area Coverage (km²) of deteriorated coastal wetlands; Level of deterioration of different types; Area Coverage (km²) of drained Coastal Wetlands and organic soils	Assesses the extension of total deterioration of coastal wetlands based on parameters such as pollution levels, Invasive species presence, drainage, and physical alterations.
	Risk Posed by Invasive Species	Area Coverage (km²); Population size; Number of Invasive species	Assesses the size of populations and extension risk posed by invasive species (species strictly regulated + species of concern) to natural coastal wetland ecosystems.

Coastal Wetland Restoration Rate 	Hydrological Connectivity	Km of free-flowing rivers connected to coastal wetlands being restored	Evaluates changes in water flow patterns and connectivity between wetland areas
	Surface and Groundwater Restoration	Threshold values	Based on the WFD, it examines trends on water restoration efforts from multiple dimensions of surface and groundwater status, particularly quality and quantitative.
	Pollutant Reduction Effectiveness	Percentage decrease in concentrations of key pollutants	Evaluates the trend reductions in pollutant levels to meet the targets set by the Zero Pollution Action Plan, the MSFD and the WFD.
	Barrier Impact Index	% change in natural water flow patterns due to the elimination of barriers	Assesses the impact of physical barriers (e.g., roads, dams, levees, dikes, ports) on the ecological connectivity, hydrological flow (marine and coastal).
	Restoration Potential	National plans that prioritize coastal wetland restoration Area Coverage (km^2) of potential restored habitats from the proportion deteriorated	Assesses efforts to help identify and prioritise areas for coastal wetland restoration.
	Restoration Progress	Area Coverage (km^2) of habitats of coastal wetlands restored and under restoration Number of Countries Area Coverage (km^2) of coastal wetlands with restored drainage systems	Percentage change in condition or extent specifically attributable to coastal wetland areas under active restoration or restored from the percentage of area deteriorated. Habitats refers to habitat types listed in Annex I and II to the Habitats Directive and Annex II to the EU NRR.
Vulnerability to Climate-Related and Natural Disasters 	Coastal Wetland Vulnerability	Index score	Assesses the vulnerability of coastal wetlands to various environmental stressors, particularly climate change impacts such as sea-level rise, storm surge, and increased frequency of extreme weather events.
GHG Emissions and Abatement from Coastal Wetland Land Use Conversion and Restoration 	Land Use Conversion Area	Percentage Change of converted coastal wetland area	Proportion at which coastal wetlands are convertedto other land uses over time (from reference reporting period) to assess the effectiveness of land use policies to conserve natural carbon sinks such as wetlands.
	Extended Coastal Wetland Habitat Loss/Gain Ratio	Area Coverage (km^2) of total coastal wetlands	Compares the area of wetland habitats lost to development or other uses against the area gained through conservation and restoration activities.
	GHG Emissions and Removals from Land Converted Wetlands	GHG emissions and removals /ha/year following wetland conversion	Tracks losses and emissions of CO_2, methane, and nitrous oxide resulting from the conversion of coastal wetlands to other land uses.
	GHG from Coastal Wetland Restoration	GHG emissions/ha/year following wetland restoration	Tracks the net balance of CO_2, methane, and nitrous oxide from coastal wetland restoration.

Share of Utilised Agricultural Area (UAA) under Common Agricultural Policy (CAP)– Supported Commitments in Coastal Wetlands	Share of Agricultural Area in Coastal Wetlands	Ha of land used for agriculture within coastal wetlands. Ha of UAA within coastal wetlands that are managed under CAP-supported initiatives.	Tracks the adoption of sustainable agricultural practices and helps evaluate the impact of CAP policies on emission reduction and carbon storage.
	Agricultural Carbon Seques-tration and GHG Reduction Index in Coastal Wetlands	Carbon Sequestration Rate and GHG emissions/ ha/year from CAP Agriculture land in coastal wetlands	Tracks the adoption of agriculture lands to reduce emissions or to maintain or enhance carbon storage on agricultural land in coastal wetlands.
Overall Funding Sources for Coastal Wetlands 	Coastal Wetland Funding	Euros per reporting period	Evaluates the overall funding landscape for coastal wetlands, assesses the availability, from various sources, including government agencies, non-governmental organisations, international bodies, and private sector contribution.

Source: RESTORE4Cs Policy Brief "European Coastal Wetland Indicators: A proposal for monitoring policy process across space and time".

Table 6: Policy indicator values in Romania on "Extension of coastal wetlands protected and strictly protected" (December 2025).

Policy Outcome Indicator	Metric title	Units	Indicator value in Romania
Extension of Coastal Wetlands Protected and Strictly Protected	Total coastal wetland extent under strict protection	% / km²	**0.05%** **Area: 3.06 km²** (Reference year: 2025)
	Total coastal wetland extent in Natura 2000 sites	% / km²	**87.42%** **Area: 5,170.89 km²** (Reference year: 2023)
	Total coastal wetland extent designated as Ramsar and part of the Natura 2000 network	% / km²	**65.64%** **Area: 3,882.75 km²** (Reference year: 2025)
	Total coastal wetland protected as Nationally Designated Area	% / km²	**13.62%** **Area: 805.72 km²** (Reference year: 2024)

Source: Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform.

Key recommendations

→ Complement **reporting metrics for wetlands and spatial data layers** which are already used at national level with the policy outcome indicators of the Policy Progress tracking tool.

→ Include **policy outcome indicators in national strategies** or actions plans (e.g. National Restoration Plan) to monitor progress in wetland restoration.

Identify potential restoration sites for coastal wetlands

- → **Map areas of historical wetland loss resulting from past land-use conversion and infrastructure development.**
- → **Assess wetlands with the highest potential for regeneration, focusing on habitat restoration and recovery of hydrological processes.**

The systematic identification of areas suitable for wetland restoration gives the foundation for setting more specific restoration targets and optimising investment of limited resources for restoration within a country.

Support from RESTORE4Cs

The approach for locating and prioritising potentially restorable wetlands in Romania is based on work of the RESTORE4Cs project, taking into account historical wetland distribution, current land cover and land use and ecological benefits.

The *Potential Wetland Areas* (PWA) map in Figure 5 shows the intrinsic likelihood of wetland occurrence across Romania, independent of current land use or degradation. The spatial pattern is dominated by **very high and high probabilities** (dark and light blue shades) concentrated in the **Danube Delta, lower Danube floodplain, and coastal plains**, as clearly illustrated in the map. Smaller but distinct corridors of medium probability follow major river valleys such as the Siret, Prut, Olt, Mureș and Tisza, hinting at historical floodplains and hydrologic depressions.

By contrast, the **Carpathian Mountains and the higher hill regions** show predominantly *very low to low probability* (brown to light brown areas). These areas, although containing pockets of peatlands or riparian wetlands, are generally less conducive to extensive wetland formation due to steep terrain, rapid drainage, and lower floodplain development.

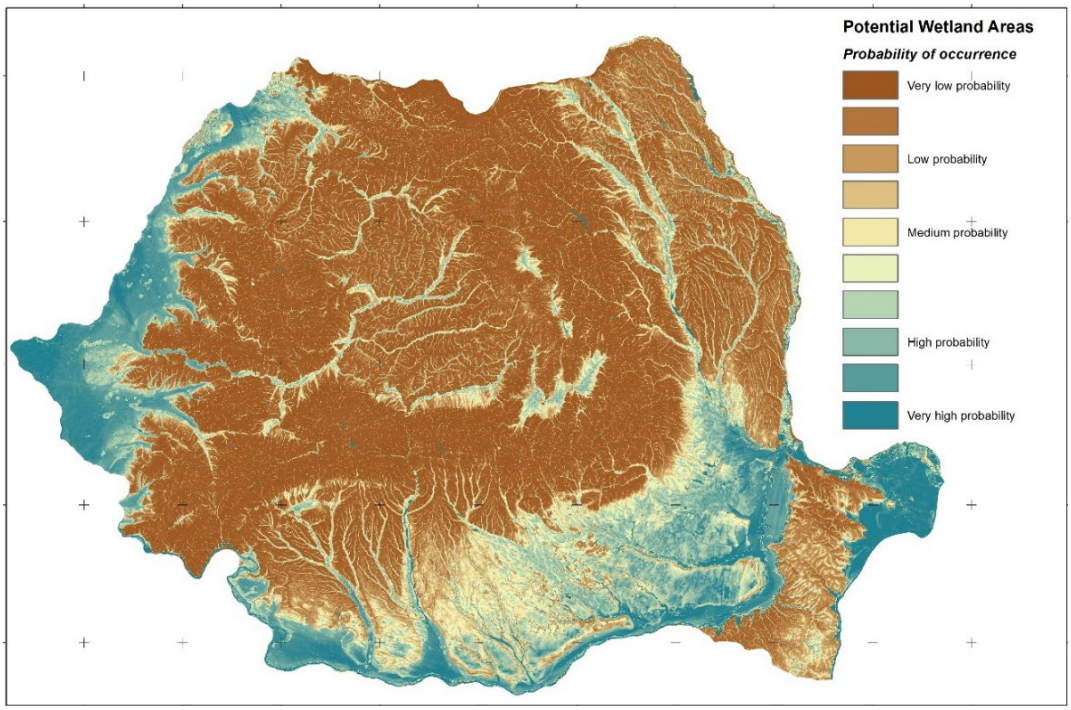


Figure 5: Potential Wetland Occurrence Areas. Source: Spatial Decision-Support Toolbox on the European Coastal Wetlands Interactive Platform.

Taken together, the PWA map, represents a kind of **hydrogeomorphic template**, a depiction of where wetlands *would naturally occur* if left to environmental processes. It underscores the strong alignment between wetland potential and Romania's major lowland hydrological systems.

The *Potentially Restorable Wetlands* (PWR) map in Figure 6 offers a more pragmatic perspective: it identifies areas where wetland restoration is feasible given current land conditions, degradation patterns, and hydrological constraints. As shown, a large portion of Romania appears in **red (not suitable)** for restoration, mostly uplands, intensively modified agricultural plateaus, or areas with substantial hydrological alteration.

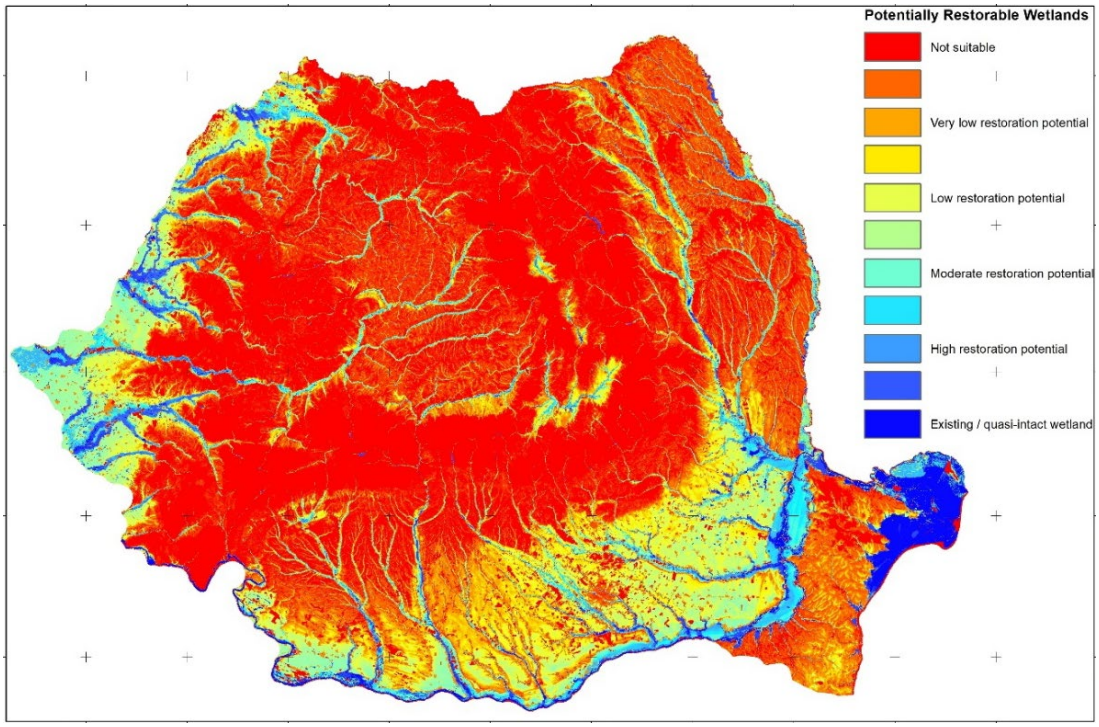


Figure 6: Potentially Restorable Wetlands. Source: Spatial Decision-Support Toolbox on the European Coastal Wetlands Interactive Platform.

Note: The accuracy of the PRW map is highly dependent on the quality of the Land Use Land Cover and wetland extent maps used as input data. In this case, input data included CLC 2018 for Land Use Land Cover and the European Wetland Map produced by the ALFA-Wetland / WET-Horizon projects. Final PRW outputs could be significantly improved if more accurate and robust national datasets on Land Use Land Cover and wetland inventories become available.

However, the Potential Restorable Wetland map reveals a set of key restoration opportunity zones:

- **High to very high restoration potential (blue and dark blue)** is concentrated in the **Danube Delta, coastal lagoon complex, and lower Danube floodplain**, corresponding well to the areas identified as having very high wetland potential in the PWA map.
- **Moderate restoration potential (green-cyan)** follows the **middle and lower stretches of major rivers**, especially the Siret, Prut, Olt, and Mureș valleys, indicating hydrologic contexts where partial restoration (e.g., reconnecting floodplains, rewetting depressions) is feasible.
- **Existing or quasi-intact wetlands (deep blue)** are primarily located in the Danube Delta and adjacent lagoon systems, confirming their status as Romania's most extensive intact wetland complex.

This map suggests that while Romania has a wide natural potential for wetlands, **actual restoration feasibility is constrained** by land conversion, hydrological separation, and intensive agriculture in many regions.

When examined together, the two maps on PWA and PRW reveal a narrative of **opportunity, constraint, and priority**:

a. Areas where Potential Wetland Areas and Potential Restorable Wetland overlap strongly

In the **Danube Delta, lower Danube corridor, and coastal lowlands**, both maps identify:

- High natural wetland potential
- High restoration potential or existing wetland integrity

These zones represent the **core of Romania's wetland restoration value**, combining ecological suitability, hydrological coherence, and feasibility.

b. Areas with high natural potential but low restoration feasibility

Several interior river valleys show **medium potential in the Potential Wetland Areas** but **low to very low restoration potential** in the **Potential Restorable Wetland map**. These areas likely correspond to regions where:

- Agricultural or industrial conversion is extensive,
- Drainage infrastructure is entrenched,
- Settlements or transport networks limit hydrological reconstruction.

This discrepancy highlights places where restoration is either cost-prohibitive or where trade-offs with existing land uses are substantial.

c. Areas with low natural potential and low restoration feasibility

The **Carpathians and sub-Carpathian hills** consistently appear unsuitable in both datasets. Wetland presence here is limited to isolated peatlands, riparian strips, or small depressions, meaning that restoration efforts would not yield extensive wetland landscapes. However, given the high carbon mitigation capacity of peatlands, targeted local restoration of these isolated peatland areas should be considered to maximise climate benefits despite their limited spatial extent.

These maps collectively guide strategic restoration planning:

- The **Danube Delta and lower Danube floodplain** remain the unrivalled hotspot for wetland conservation, enhancement, and carbon-related restoration actions—supported simultaneously by natural potential and restoration feasibility.
- **Major river corridors** (Siret, Prut, Olt, Mureș) provide opportunities for targeted, site-specific interventions aimed at re-establishing hydrological connectivity and riparian wetland functions.
- Restoration in heavily modified lowlands requires **innovative approaches**—such as controlled flooding, reconnection of abandoned meanders, and nature-based retention structures—to navigate the gap between natural suitability (high **Potential Wetland Areas**) and feasibility (low **Potential Restorable Wetland**).
- The maps highlight the importance of **prioritisation frameworks**: not all theoretically suitable areas can be restored, but the intersection of **Potential Wetland Areas** and **Potential Restorable Wetland** pinpoints interventions with the highest ecological return on investment.

Key recommendations

→ **Prioritise restoration in areas where natural wetland potential and restoration feasibility overlap**

Both maps indicate a strong convergence of high suitability and high feasibility in the Danube Delta, lower Danube floodplain, and Black Sea coastal wetlands. Authorities should designate these as national priority zones for wetland restoration, carbon sequestration, biodiversity enhancement, and climate resilience under programmes such as the National Recovery and Resilience Plan (PNRR) and EU Green Deal funding.

→ **Strengthen legal protection and land-use planning in high-potential floodplains**

Many river valleys (Siret, Prut, Olt, Mureș, Tisza) show medium natural potential yet limited feasibility, reflecting intense land conversion. Authorities should:

- integrate Potential Wetland Areas zones into county-level spatial plans,
- restrict further drainage and conversion,
- introduce ecological corridors that reconnect floodplain elements.

This helps avoid further loss of restorable wetlands and maintains long-term options for nature-based solutions.

→ **Accelerate restoration actions in the Danube Delta and coastal systems**

Given the concentration of high and very high restoration potential, authorities should:

- expand rewetting and hydrological reconnection projects,
- simplify permitting for ecological restoration interventions,
- facilitate cross-sector coordination between fisheries, tourism, water management, and conservation bodies.

→ **Develop site-specific restoration strategies for moderate-potential river corridors**

In central and eastern lowlands, moderate restoration potential suggests opportunities for targeted measures such as:

- controlled flooding in agricultural polders,
- reactivation of abandoned meanders,
- riparian buffer establishment,
- floodplain reconnection during high-flow periods.

Authorities should provide guidance to water basin administrations for river-specific restoration plans aligned with hydrological realities.

→ **Create financial incentives for landowners in feasible restoration zones**

Restoration often competes with agriculture. Authorities should explore:

- compensation mechanisms for land set-aside,
- payments for ecosystem services (PES),
- carbon credit frameworks for peatland and floodplain rewetting.

→ **Support community involvement in high-feasibility areas**

- establish Local Advisory Groups during planning,
- integrate local knowledge into target-setting,
- support rural development projects tied to wetlands (e.g., eco-tourism, sustainable fisheries).

05

Plan restoration activities

5. Plan restoration activities

While the identification of priority areas for restoration of coastal wetlands is an exercise which can take place at national and regional level, the planning of suitable restoration actions takes place for specific selected sites site requiring the identification of specific restoration techniques which are cost-effective and also socially acceptable in the specific site context.

The following section of this roadmap proposes an approach for the assessment of benefits and costs of coastal wetland restoration actions which has been tested in the case pilot of RESTORE4Cs at the Danube Delta and can be replicated for restoration planning in other sites.

Assess the benefits and costs of coastal wetland restoration actions

- → **Identify the most cost-effective restoration actions for coastal wetlands based on available evidence and resource constraints.**
- → **Evaluate the performance of different restoration options across multiple dimensions, including social, environmental, and economic benefits.**
- → **Assess the level of social acceptability of various restoration actions within the relevant local and regional contexts.**

Restoring coastal wetlands is a multidimensional planning challenge involving trade-offs between ecological, social, and economic priorities. Restoration actions can yield substantial benefits, such as carbon sequestration, biodiversity recovery, and flood regulation. However, they also come with costs, namely financial, social, and sometimes political. To be successful, restoration planning must evaluate both the cost-effectiveness of interventions and their social acceptability. The latter is necessary to reflect the local needs and values, ensure support at the level where implementation and maintenance efforts take place. Restoration scenarios that ignore local preferences or undervalue societal co-benefits risk resistance, failure, or unintended harm. For this reason, transparent, evidence-based evaluation of benefits, costs, and stakeholder values is essential to ensure long-term impact, sustainability and legitimacy of restoration actions.

In Romania, particularly in the Danube Delta, costs and benefits assessments of coastal wetland restoration are a key priority. Some areas, such as those near Mahmudia in Tulcea County, where the Carasuhat wetland restoration project was implemented, local livelihoods are often perceived as being linked to agricultural land use. In practice, however, the local community did not directly benefit from agriculture, as residents were not employed by the company exploiting the agricultural land, nor were profits redistributed locally. Instead, local communities have historically derived greater benefits from the presence of water and functioning wetland ecosystems, including fisheries, tourism, and improved environmental conditions. Nevertheless, transitions from agricultural use to conservation-oriented land management can initially raise concerns related to employment, land value, and governance arrangements.

The Carasuhat case therefore shows that participatory planning and strong stakeholder engagement can build local support by highlighting opportunities for sustainable tourism and improved living conditions. In this context, costs and benefits assessments help estimate these expenses and opportunities, resulting from restoration actions, making them more visible.

Support from RESTORE4Cs

RESTORE4Cs applied a participatory **Multi-Criteria Analysis (MCA)** framework to assess stakeholders' preferences for multiple restoration options in six case pilot sites, including Danube Delta, for coastal wetland restoration, integrating ecological, socio-economic, and socio-cultural indicators.

The MCA framework is highly applicable to wetlands restoration decision-making as a multidimensional analysis tool which integrates social perception of criteria importance. It is suitable for the evaluation and comparison of alternatives based on more than one criterion or objective which are difficult to quantify or express in monetary terms. In comparison, other economic evaluation tools like cost-effectiveness analysis and cost-benefit analysis tend to be applicable for monetised or single variables, while by definition wetlands restoration requires to consider a set of different factors.

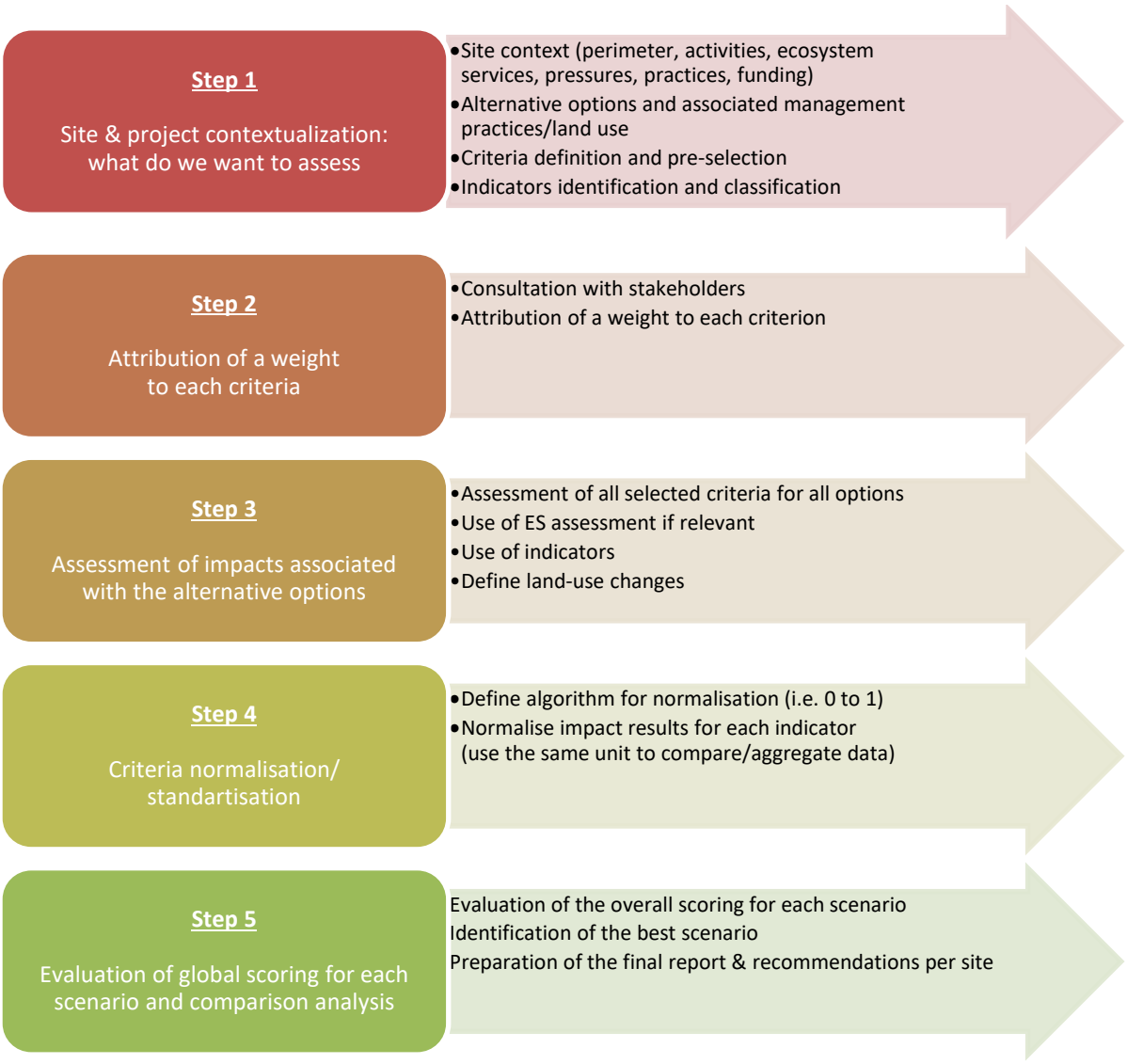


Figure 7: MCA Methodology steps applied to RESTORE4Cs case pilot sites. Source: RESTORE4Cs Deliverable "Report on cost/benefit analysis of wetland restoration options and on financing tools" (2025).

Following the methodological steps for conducting an MCA of coastal wetland restoration in the RESTORE4Cs case pilot sites (Figure 7), costs and benefits of the pilot site in the Danube Delta were assessed.

As part of Step 1, two options or scenarios were defined:

1) **Limited restoration (Business as Usual)**, characterised by limited quantity and quality of restored wetlands, unlikely to contribute to a favourable conservation status and related role of wetlands for climate change mitigation;

2) **Active restoration of wetlands**, defined by improvement of wetlands state in quality and quantity, contributing to delivering social benefits and climate change mitigation.

In Step 2 and 3, a round of interviews[30] with four stakeholders took place to collect more information about the context and issues of the Danube Delta, which was followed by a workshop[31] with nine local stakeholders[32] to rate criteria, pre-selected by project partners and approved by the local case pilot leaders, across **socio-economical** (agriculture, fishing, tourism/recreational activities, jobs created or lost following restoration, investment costs, maintenance costs), **environmental** (aquatic habitats created/preserved or lost, species richness, global climate regulation, water quality improvement, water flow improvement), and **socio-cultural** (accessibility to public green areas, aesthetic, disturbance following restoration, scientific research, education and recreative interest) themes. For each criterion, an associated indicator was selected to assess the intensity of importance of the criterion in decision-making.

As a result of a weighing exercise, the categories considered in priority by local stakeholders when implementing a restoration project are the '**Socio-economic' activities** (agriculture, fishing, tourism) and **'Costs of the restoration project'** (investment and maintenance costs) categories (see Table 7). Notably, tourism and recreational activities were not perceived negatively by local stakeholders and received higher ranking than agriculture, for example. Additionally, local stakeholders selected the topic of maintenance costs as a priority, highlighting the need to attract additional funding to sustain restoration outcomes after the project ends.

30 RESTORE4Cs Guidance for Step 1 of the MCA – interviews can be accessed in Annex 7.2 of the Report on cost/benefit analysis of wetland restoration options and on financing tools. Available at: https://www.restore4cs.eu/about/workplan/ (WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

31 RESTORE4Cs Guidance for Step 2 of the MCA – Workshop can be accessed in Annex 7.3 of the Report on cost/benefit analysis of wetland restoration options and on financing tools. Available at: https://www.restore4cs.eu/about/workplan/ (WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

32 The list of stakeholders involved: Danube Delta Biosphere Reserve Authority, Tulcea County Environmental Protection Agency, "Danube Delta" National Institute for Research and Development, Tulcea County Council, WWF Romania, Doborgea-Litoral water management authority, Mahmudia village local authority, "Danube Delta" federation of fisheries organisations, and "Euro Pesca" organisation.

Table 7: Example of criteria used and their weight when considering restoration projects, according to stakeholders (9 respondents) in the RESTORE4Cs Danube Delta case pilot site.

Level 1 (Themes)	Weight	Level 2 (Categories)	Weight	Level 3 (Criteria)	Weight
Socio-economics	**34%**	Socio-economics activities	**12%**	Agriculture	**29%**
				Fishing	**36%**
				Tourism / Recreational activities	**35%**
		Employment	**11%**	Jobs created or lost following restoration	
		Costs of the restoration project	**12%**	Investment costs	**52%**
				Maintenance costs	**48%**
Environment	**39%**	Habitats	**11%**	Aquatic habitats created/preserved or lost	
		Biodiversity	**11%**	Species richness	
		Climate	**9%**	Global climate regulation	
		Water cycle	**8%**	Water quality improvement	**53%**
				Water flow improvement	**47%**
Socio-cultural	**27%**	Cultural landscape and land uses	**7%**	Accessibility to public blue green areas	
		Values and beliefs	**6%**	Aesthetic	
		Perceived risks and uncertainties	**6%**	Disturbance following restoration	
		Local awareness and knowledge	**7%**	Scientific research	**51%**
				Education & recreative interest	**49%**

Source: RESTORE4Cs Deliverable "Report on cost/benefit analysis of wetland restoration options and on financing tools" (2025).

The categories' weights that do not reach 10% are considered less important to the local stakeholders but still should not be disregarded. In particular, the socio-cultural categories' weights are much lower compared to the environmental and socio-economic categories.

In Steps 4 and 5, using the 'Min-Max' normalisation method, both scenarios were assessed, with **the scenario Active restoration of wetlands obtaining a significantly higher value**, making it the **best alternative** for the Danube Delta context. This result indicates that the Active restoration scenario makes a positive contribution to a greater number of indicators than the other scenario.

Furthermore, analysing the results of the MCA using the 'Max' normalisation method also showed that the Active restoration of wetlands scenario supports greater number of indicators in terms of weightings. Notably, despite requiring the **highest investment and maintenance costs**, the **Active restoration scenario still emerges as the most favourable overall**.

Based on the results of the MCA model, actively restoring wetlands by improving their surface and condition could help achieve a balanced set of socio-economic, environmental, and socio-cultural functions in the Danube Delta by 2050. At the same time, it would generate the greatest reduction in the area's global warming potential, strengthening climate resilience, and remain socially acceptable to local stakeholders.

Risks and uncertainty associated with this assessment:

- Not all socio-economic interests were represented, which may introduce a bias toward environmental criteria;
- The accuracy of the weighting exercise completed by local stakeholders needs to be verified before using this data for further assessments;
- This model, though providing additional elements to keep in mind, cannot be used to predict an exact tipping point at which a scenario will cease to be the best alternative, simply based on costs.

Replicability

The methodology used to assess the costs and benefits of restoration in the Danube Delta can be applied to other sites within this wetland complex. The indicator list specifically developed for the MCA in the Danube Delta context can serve as a starting point and be adapted to the specific characteristics of other coastal wetland types and restoration sites within the Delta or across other coastal wetlands in Romania. Likewise, the preliminary selection of stakeholders, procedures for gathering stakeholder insights and preferences, such as questionnaires, interviews, workshops, and the overall step-by-step approach to implementing the MCA can be applied to other Danube Delta sites. This flexibility makes the methodology suitable for replication across different wetland sites.

Key recommendations

→ **Multi-Criteria Analysis (MCA)** is recommended **to assess restoration options** beyond just cost or climate benefits, including social and ecological aspects. In doing so, it is necessary to engage stakeholders early to reflect local values, capture their preferences and ensure for the social acceptance of restoration plans. A pre-analysis of the socio-cultural and socio-economic background is important to prepare the ground in the most efficient way.

→ Ensure **balanced stakeholder representation in the MCA**. Promote strong stakeholder participation and ensure the weighting exercise is completed accurately.

→ Use the results of this case study MCA as a foundation for conducting **further analysis with higher stakeholder participation and representativeness** and strengthening social acceptance of restoration measures in the identified proposed sites.

→ Consider carrying out a **"willingness to pay" assessment** with local stakeholders and compare the results with the MCA to identify a realistic tipping point at which the business-as-usual scenario becomes as favourable as the active restoration scenario.

→ To ensure coverage of maintenance costs, identified as a priority in the Danube Delta context, and, hence, long-term sustainability of restoration benefits, consider applying **innovative financing solutions**, such as payment for ecosystem services mechanisms, linked to carbon storage, biodiversity credits, or nutrient offsets; blended finance instruments, combining public seed funding with private investments; environmental trust funds or revolving funds. Use a financial plan developed by RESTORE4Cs for the Danube Delta restoration[33].

33 Anglada, C. et al. (2025). Report on cost/benefit analysis of wetland restoration options and on financing tools. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

06

Stakeholder collaboration and partnerships

6. Stakeholder collaboration and partnerships

Establish clear competences of public authorities on coastal wetland restoration

- → **Identify public authorities with competences for coastal wetland restoration and conservation at national and regional levels.**
- → **Map institutional responsibilities across policy fields, including climate, nature, water, and coastal/marine protection and management.**
- → **Assess roles in policy development, planning, monitoring, and enforcement related to coastal wetland restoration and conservation.**
- → **Evaluate overlaps and gaps in competences to identify opportunities for improved coordination and conflict avoidance.**

Coastal wetlands are usually subject to the jurisdiction of multiple bodies and administrations. In Romania, the system of land ownership and the management of water infrastructure (e.g., dykes), riparian land, and water bodies is highly fragmented. This fragmentation results in overlapping responsibilities and unclear competences. The transboundary nature of the Danube Delta further complicates the governance of coastal wetland restoration. It is therefore important to clearly define the public authorities responsible for coastal wetland conservation and restoration and to establish well-defined competences.

To identify needs for improvement in the governance setting, as a first step, the roles and duties on coastal wetland conservation and restoration across different governance levels and policy fields should be described and clarified:

- Both authorities in the national government and regional governments should be considered. At national level, the lead authority responsible for policy on coastal wetland restoration and conservation should be defined, and if there is more than one, the respective responsibilities clarified. At regional (sub-national) level, institutions responsible for restoration and conservation programmes on coastal wetlands should be identified. Furthermore, the general scope of responsibilities of coastal municipalities as local level stakeholders should also be defined.
- Authorities in the main relevant policy fields should be taken into account, namely authorities with competence in climate change mitigation & adaptation, nature & biodiversity, water management, as well as coastal/marine planning and management. Often wetlands are effectively represented within nature restoration and water management policy fields, but their climate mitigation role is less adequately captured in the governance setting where no public bodies are specifically responsible for coastal wetlands.
- It should be clarified which public authorities at national, regional (sub-national), and, if relevant, local level are responsible for policy, planning, monitoring, enforcement in the field of coastal wetland restoration and conservation.

Support from RESTORE4Cs

A mapping exercise was conducted to identify Romania´s public authorities responsible for various aspects of coastal wetland restoration[34]. The results are presented in Table 8.

Table 8: Overview of Romania´s public authorities responsible for various aspects of coastal wetland restoration (Danube Delta) and their respective responsibilities.

National level	
Name	**Competences with relevance for coastal wetland conservation and restoration**
Ministry of Environment, Waters and Forests	• "Organised and functions as a specialised body of the central public administration, with legal personality, subordinate to the Government"; responsible for ecological resilience, climate change, protecting, conserving and improving natural capital in the field of water and forests; protected natural areas; biodiversity protection, conservation and restoration (Art. 1 of law H.G. no. 43/2020[35]). It is, therefore, responsible for regulating the conservation to coastal wetlands. • Administers waters in public domain of the state and the infrastructure of the National Water Management System together with the National Administration "**Romanian Waters**" • enforces wetland restoration regulations through its local **Environmental Protection Agencies** and the National Administration "**Romanian Waters**".
National Environmental Protection Agency (EPA)	Together with local environmental protection agencies and the National Administration "**Romanian Waters**" are responsible for wetland monitoring.
National Administration "Romanian Waters"	• has responsibilities for regulating and monitoring the use of beaches on the Black Sea coast. • Supports the Ministry and the EPA in administration, enforcement, and monitoring (see above).
National Ramsar Committee	Responsible for the development of proactive management strategies aimed at preserving, restoring, or ecologically reconstructing wetlands of international significance, particularly those serving as habitats for waterfowl, especially the Danube Delta.
Sub-national (county) level	
County´s EPAs (especially in Constanta and Tulcea)	• Responsible for policy implementation regarding wetland restoration. • Monitoring of wetland restoration efforts
Dobrogea Litoral Water Division (Romanian Waters)	• Planning for wetland restoration
Danube Delta Biosphere Reserve Administration	• Planning for wetland restoration • Drafting and implementation of the management plans for the Danube Delta Biosphere Reserve

34 Kampa, E. et al. (2024). Policy analysis and policy demands for data, methods, and tools (Part A). Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

35 Government Decision No. 43 of January 16, 2020, Official Gazette No. 55 of January 28, 2020. https://legislatie.just.ro/Public/DetaliiDocumentAfis/222504.

	• Monitoring of wetland restoration efforts • Enforcement of wetland restoration policies
Environmental Guard Commissariats	• Enforcement of wetland restoration policies
Coastal Guard (Constanta and Tulcea Counties)	• Enforcement of wetland restoration policies
Public authorities at NUTS level 3 (Constanta and Tulcea County Councils)	• Planning for wetland restoration
Local level	
Authorities at LAU level (Municipalities, Communes)	• Planning for wetland restoration

It was found that institutional coordination for coastal wetlands remains weak, as multiple agencies operate with limited communication and overlapping responsibilities. No single authority holds a clear mandate for managing coastal wetlands, resulting in gaps in enforcement, planning, and resource allocation. Cross-sectoral cooperation is also limited, with policies in water management, agriculture, fisheries, and local development often developed in isolation. This fragmented governance structure hinders coherent decision-making and slows progress on effective conservation and restoration efforts.

Key recommendations

→ Consider establishing a **dedicated authority responsible for coastal wetland ecosystems** as a whole (see the example of the new Authority for the Venice Lagoon, Italy[36], intended as a unique body, "able to assume all competences presently distributed among various different actors") or at least start with a dedicated role within an existing public authority body. Enable knowledge and practice exchange with existing Member States´ authorities solely or primarily responsible for coastal wetland conservation and restoration to support the establishment of a specialised national body. The public authority body should have competences covering the variety of coastal wetland habitats based on their hydro-ecological characteristics and not limited by the official Ramsar borders of the Danube Delta or Natura 2000 borders.

→ Strengthen coordination and communication among responsible public authorities by establishing **inter-ministerial working groups** that reflect the multifunctionality of coastal wetlands. Implement formal cooperation procedures, such as shared work programmes and joint consultation rounds, supported by an agreed timeline and a coherent, cross-sectoral internal strategy.

→ Use the present assessment as a foundation for identifying more substantial overlaps or gaps in institutional competences. Build on this assessment to take stock of existing roles, clarify mandates, and **ensure that responsibilities are clearly defined and mutually coherent** across all relevant authorities.

→ Develop structured procedures to ensure involvement of local authorities in the decision-making process regarding coastal wetland conservation and restoration.

36 Terisse, A. et al. (2023). Characterising supportive governance and policy. Deliverable. WaterLands. Available at: https://cdn.sanity.io/files/34jdpbeg/production/5998e2ff94dad02b23da477813737a84c763070a.pdf

Establish a governance structure that enables collaboration and trust between stakeholder and builds long-term commitment towards restoring wetlands

→ **Identify key stakeholders to be included in a governance structure that facilitates collaboration among government agencies, scientific institutions, NGOs, and local communities, and define their respective roles and responsibilities.**

→ **Assess mechanisms for incorporating local community interests into decision-making processes to ensure inclusivity and social acceptance of restoration actions.**

Large-scale restoration of coastal wetlands may often imply changes in land uses and in the spatial distribution of socioeconomic activities. Landscape modification also touches many socio-cultural dimensions such as the identity, history, values, cultural knowledge and beliefs of local communities. Restoration may therefore face opposition or be blocked by influential societal actors.

Moreover, the sustainability of the restoration results over time often depends on the engagement and stewardship of local communities. For this reason, a sustainable process to restore and re-shape the territory should foresee an inclusive participatory process, covering consultations with key stakeholders, informative meetings that are open to the public and an assessment of sectoral needs, besides ensuring public access to information on the state of natural resources. This process should build trust among actors, foresee conflict resolution procedures, and support coordination and cooperation among stakeholders[37].

Restoring coastal wetlands in the Danube Delta and along Romania's Black Sea shoreline requires a governance structure capable of weaving together policy, scientific evidence, local experience and on-the-ground implementation. The RESTOR4Cs project offered an opportunity to bring together and align national and local stakeholders around shared climate, biodiversity, and socio-economic objectives. However, such alignment depends on a governance model that deliberately cultivates collaboration between various stakeholder groups and ensures its maintenance in the long term. This structure must not only coordinate actions across disciplines and jurisdictions but also create an environment in which each actor's knowledge, interests and capacities can shape restoration pathways.

Within this governance model:

- **national and regional public authorities** provide the regulatory backbone, ensuring that restoration interventions comply with national legislation and EU directives, integrate with land-use planning, and contribute to broader basin-level strategies such as those defined under the WFD and the MSFD.
- **Romanian research institutions** supply the analytical and monitoring foundations. Their work enables evidence-based scenario development, assessment of climate mitigation co-benefits, and the evaluation of long-term ecological outcomes.
- **Non-governmental organisations (NGOs)** play an essential bridging role, connecting institutional processes with societal expectations and ecological realities on the ground.

37 De Oliveira, M. et al. (2024). Governance of coastal wetlands: Beyond the community conservation paradigm. Ocean & Coastal Management, 255, 107253. https://doi.org/10.1016/j.ocecoaman.2024.107253.

- **Private-sector actors**, particularly those in eco-tourism, sustainable fisheries, agriculture and restoration-related engineering, support implementation and help translate restoration strategies into economically viable local opportunities.
- The deliberate and meaningful inclusion of **local communities** should be placed at the core. The Danube Delta's residents, fishers, reed harvesters, farmers, and minority groups carry generations of knowledge about hydrological dynamics, species movements and resource cycles. Their perspectives are indispensable in designing interventions that respect cultural practices, safeguard livelihoods, and generate shared economic benefits. Community involvement should extend beyond consultation to active participation in co-design, co-creating monitoring and stewardship.

Support from RESTORE4Cs

Through a multi-layered approach presented above, the governance structure becomes both a coordination mechanism and a platform for joint learning. This approach demonstrates how climate-smart coastal restoration can succeed when scientific insight, public policy, community experience and economic interests are held together in a cohesive, collaborative framework.

Table 9 presents the key stakeholder groups, examples of key actors to be engaged, as well as their respective roles in a collaborative governance structure to be established for coastal wetlands restoration in Romania. The Danube Delta was selected as an example restoration site, being the main coastal wetland complex in Romania.

Table 9: Key stakeholder groups in the Danube Delta for a collaborative governance structure.

Stakeholder Group	Key Actors (Examples)	Roles in Governance & Restoration	Primary Interactions
National Government Agencies	Ministry of Environment, Waters and Forests; National Agency for Protected Natural Areas; National Ramsar Committee	Policy making, permitting, alignment with EU directives, national monitoring	Work with regional authorities, researchers, NGOs; approve restoration plans; share data
Regional & Local Public Authorities	Danube Delta Biosphere Reserve Authority (DDBRA); Tulcea & Constanța County Councils; River Basin Authorities	Spatial planning, local regulation, coordination across municipalities, site management	Coordinate with national agencies; engage communities; collaborate with NGOs and scientists
Scientific Institutions & Researchers	Danube Delta National Institute for Research and Development (DDNI); National Institute for Marine Research and Development "Grigore Antipa" (NIMRD); University of Bucharest	Ecological modelling, climate assessments, monitoring design, scenario development	Provide analyses to authorities; collaborate with NGOs; support communities with technical info
NGOs & Civil Society	WWF Romania; WWF Central and Eastern Europe (CEE); Romanian Ornithological Society (SOR); Rewilding Romania; local conservation groups (e.g., Eco-Dobrogea, Mare Nostrum)	Public outreach, advocacy, participatory facilitation, biodiversity expertise	Support community engagement; communicate with authorities; collaborate with scientists

Local Communities	Fishers (e.g., Traditional Fishermen´s Village in Tulcea), farmers, reed harvesters, tourism operators, minority groups, local councils	Traditional knowledge input, co-design of interventions, stewardship, local monitoring	Interact with authorities, NGOs and researchers; participate in advisory groups; co-manage sites
Private Sector Actors	Eco-tourism operators; sustainable fisheries; engineering firms	Implementation of restoration works, innovation, co-financing opportunities	Work with authorities on permits; partner with NGOs; collaborate with communities for local benefits
International / Cross-Border Bodies	The International Commission for the Protection of the Danube River (ICPDR); Ramsar networks; EU agencies	Provide standards, guidance, transboundary coordination, best practices	Exchange data with national agencies; support scientists; ensure cross-border alignment

The box below presents key learnings from the RESTORE4Cs project that will support the development of inclusive participatory structures for coastal wetland restoration in Romania, involving actors presented above in Table 9.

Learnings from the RESTORE4Cs for developing inclusive participatory structures:

- Ensure a balanced representation of sectors, ensuring underrepresented groups are involved[38].
- Involve a 'neutral' actor or facilitator to build trust and value, to overcome intersectoral conflicts.
- Discuss real-life needs, use a direct and easy understandable language[39].
- Rather than treating stakeholders as passive receptors of information, engage them in decision-making through meaningful interactions and by assigning responsibilities.
- Identify leaders, entrepreneurs and personalities who can mobilise the community around environmental issues[40].
- Build on existing projects, events and opportunities allowing to sustain interactions as part of a consistent framework or vision, supported by short but regular interactions.
- Recognise and integrate ‘tacit knowledge’ (experience-based expertise developed by practitioners over generations).
- Develop new governance structures that sustain stakeholder and institutional commitment, while helping mobilise existing resources, raise new funds and communicate clear goals towards the local communities.

38 Conway, S. F. (2025). Multi-Actor Inclusion and Stakeholder Engagement Checklist – PREMIERE Toolsheet (Technical note). Zenodo. https://doi.org/10.5281/zenodo.15281085.

39 EC, Directorate-General for Agriculture and Rural Development. (n.d.). How can participatory methods enable communication and the embedding of the output from a multi-actor project? EU CAP Network. Available at: https://eu-cap-network.ec.europa.eu/projects/practice-abstracts/how-can-participatory-methods-enable-communication-and-embedding-output_en?.

40 Ostrom, E. (2011). Background on the institutional analysis and development framework. In M. Poteete, A. Janssen, & E. Ostrom, Working together: Collective action, the commons, and multiple methods in practice (pp. 7–27). Princeton University Press. Available at: https://idahoecosystems.org/sites/default/files/literature_resource/sustainable_social-ecological_systems_ostrom_2011.pdf.

Key recommendations

→ Conduct an extensive **stakeholder mapping** in the restoration sites like Danube Delta which involves identifying all relevant actors (governmental institutions, NGOs, scientists, private companies, local communities, and international bodies) and clarifying their roles in coastal wetland restoration. By assessing each stakeholder's interest in and influence on restoration, a targeted communication and involvement strategy can be developed to ensure that high-influence actors are involved while high-interest groups are empowered through participation and capacity building.

→ Establish a **participatory committee** for the restoration areas such as the Danube Delta, creating an inclusive platform for dialogue, enabling different stakeholder groups to contribute to planning, implementation, and monitoring of restoration activities. These committees should include clear conflict-resolution procedures, topic-specific working groups such as for climate change mitigation and carbon storage, and transparent communication to maintain trust and accountability.

→ Build partnerships with **European Community of Practice for Coastal Wetland Restoration (ECoP)**[41] to facilitate the exchange of knowledge, innovative methodologies, and best practices, connecting local restoration work with international expertise.

→ From a **Local Advisory Board** within a dedicated participation committee to ensure a meaningful local involvement, providing residents and community representatives with a formal role in shaping restoration actions. The board should establish regular review procedures to evaluate progress, identify potential impacts on daily activities, and propose locally grounded solutions. Complementary mechanisms such as socio-economic impact assessments, benefit-sharing arrangements, citizen-science monitoring, and transparent communication channels strengthen trust and ensure long-term support for restoration outcomes.

41 The European Community of Practice for Coastal Wetland Restoration (ECoP) was initiated during the RESTORE4Cs project and aims to mobilise a wide range of stakeholders to accelerate joint action for restoring and conserving wetlands across Europe and beyond. See Section 7 for more details.

07

Enabling capacities and raising awareness

7. Enabling capacities and raising awareness

The planning of coastal wetland restoration depends not only on sound science and policy, but also on the capacity of institutions, stakeholders, and the wider public to support these efforts. Often, the understanding of values that coastal wetlands and their restoration deliver is lacking among the broader public and decision-makers. This gap often leads to undervaluing wetlands compared with competing land uses, making restoration projects more difficult to justify, fund, or implement.

RESTORE4Cs research identified a low awareness and limited knowledge of climate change mitigation potential and benefits of restored coastal wetlands among local stakeholders. This affects the social acceptance of restoration actions and, hence, their overall viability[42]. These findings indicate the need for stronger engagement, trainings opportunities, and wider information dissemination among local actors. In this context, it is important to provide a broader perspective and to communicate about benefits of restoration holistically, rather than focusing solely on climate change mitigation, to achieve a higher level of stakeholder mobilisation. Specifically, as in the Danube Delta context, stakeholders have identified water quality and flow improvement as essential topics to consider while planning and implementing a restoration project, it would be important to show an interlinkage between climate regulation and water cycle benefits of coastal wetland restoration in the region.

Strengthening capacity and local skills, e.g., through training or dedicated allocation of resources (money, time, personnel), helps ensure that organisations can plan, manage, and monitor restoration effectively. Training sessions, built on the latest scientific knowledge and addressing key knowledge gaps in a clear and structured way, serve as another important communication tool in coastal wetland restoration, creating opportunities for knowledge exchange, capacity building, and collaborative learning among stakeholders. Likewise, raising awareness, including among local communities, landowners, industry, decision-makers, builds trust and encourages shared stewardship of restored areas. Building such capacities and raising awareness is a key pillar of roadmap and strategy for coastal wetland restoration.

Communication and dissemination activities play an important role in increasing the visibility of the restoration project results, using clear and accessible language, raising awareness and supporting engagement of stakeholders and creation of new partnerships. When tailored to the specifics of each target audience, communication helps connect science with the broader public, building social license, and support evidence-based policy.

European Community of Practice for Coastal Wetland Restoration (ECoP)

The ECoP initiated during the RESTORE4Cs project seeks to mobilise a wide range of stakeholders to accelerate joint action for restoring and conserving wetlands across Europe and beyond. By involving site managers, private businesses, researchers, decision-makers, civil society organisations and other restoration champions, this Community aims to:

- **Act as a knowledge hub** for practitioners and experts seeking guidance on implementing wetland restoration strategies that optimise carbon sequestration and reduce greenhouse gas emissions.

42 Sella, L. et al. (2025). Social acceptability of wetland restoration and management. Deliverable. RESTORE4Cs Project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

- **Promote cross-regional learning and the replication of successful restoration approaches** by facilitating exchanges between experts working in different ecological, cultural, and regulatory contexts. By showcasing best management practices and proven restoration techniques, the Community encourages members to adapt, adopt, and scale up effective solutions in their own regions.

This community seeks to cultivate a collaborative and respectful environment for learning and growth, where members can:

- build knowledge and skills collectively;
- identify training needs from different actors;
- co-design new training materials and initiatives.

The RESTORE4Cs Community of Practice is hosted on the Wetland-based Solutions platform (https://www.wetlandbasedsolutions.org/). Joining and participating in the Community is possible via https://www.wetlandbasedsolutions.org/community-of-practice-wetlands/.

Where to find more information

- **RESTORE4Cs Deliverable**: Social acceptability of wetland restoration and management (2025)[43]. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Key recommendations

→ Improve communication on and raise awareness of the **ecological importance of coastal wetlands, their value in ensuring social and economic sustainability of local communities and their role in biodiversity conservation, food provision, carbon storage, disaster risk reduction and climate adaptation** (wetland restoration as key investment in resilience).

→ **Demonstrate effectiveness** of coastal wetlands in addressing societal challenges and their **value for money.**

→ **Involve communities, engage local actors directly** and show case real-world examples of co-benefits.

→ **Link coastal wetlands recovery to improvements in life quality** of general public.

→ Organise **targeted trainings** to build capacities and improve the understanding and knowledge of benefits of coastal wetland restoration, especially with relation to climate mitigation potential and benefits of restoration.

43 Authors: Sella, L., Rota, F. S., Pollo, N., Vivaldo, G., Anglada, C., De Fusco, G., Ciravegna, E., Massoutier, J., Bodivit, A., Khavandgaran, S., Omidmand, M., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Beekman, V., Polman, N., Raoult, J., Giuca, R. C., Geamana, N., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M. J., Morant, D., Štrbenac, A., Lillebø, A., Sousa, A., Coelho, P., Oliveira, B.

08

Summary of Key Recommendations to Progress Coastal Wetland Restoration for Climate

8. Summary of Key Recommendations to Progress Coastal Wetland Restoration for Climate

The pilot roadmap presented in this document is intended to help national authorities and stakeholders in Romania in developing a national strategy on coastal wetland restoration. The pilot roadmap gives guidance on how to use tools and results of the EU-funded RESTORE4Cs project to improve the planning of coastal wetland restoration. The recommendations formulated throughout this roadmap aim to target specific actions that can be undertaken to define priorities for coastal wetland restoration and contribute to the achievement of key policy targets for climate and biodiversity.

The main recommendations can be summarised as follows:

- → **Establish a clear national framework for coastal wetlands –** Adopt a consistent national definition and typology of coastal wetlands aligned with Ramsar and the EU NRR to improve coherence in monitoring, planning, and reporting.
- → **Develop a national wetland strategy with restoration targets –** Move beyond site-specific protection by adopting a national wetland strategy that integrates binding conservation and restoration targets, including for coastal and transitional wetland systems. Use the momentum of the EU NRR.
- → **Strengthen condition assessment and monitoring –** Establish a national system for assessing wetland ecological condition, building on RESTORE4Cs indicators and remote sensing tools, to move from designation-based protection to condition-based management.
- → **Prioritise restoration where ecological potential, feasibility, and priority benefits overlap** in the coastal and lower floodplain areas.
- → **Address key pressures through integrated water and land management –** Tackle eutrophication, hydrological alteration, and climate-related salinisation and drought through coordinated water management, pollution reduction, and nature-based solutions.
- → **Integrate climate change mitigation into wetland policy -** Explicitly recognise coastal wetlands as climate change mitigation and adaptation assets by improving data on carbon storage and GHG fluxes and integrating wetlands into national LULUCF accounting and climate strategies.
- → **Capture restoration benefits beyond climate impacts**, including social benefits. Based on the RESTORE4Cs results from MCA, assess the costs and benefits of restoring the other wetland types within the Danube Delta and beyond while taking into account applied stakeholder selection, preference-identification approaches, and selected assessment criteria, adapting them to each context.
- → **Develop a long-term financing plan** that secures both investment and maintenance funding for restoration actions in the Danube Delta and other coastal wetland sites. Integrate blended finance mechanisms, such as PES, carbon or biodiversity markets, environmental funds, or revolving funds, to engage private stakeholders.
- → **Strengthen institutional competences** by establishing a dedicated authority for coastal wetlands and creating interministerial working groups to coordinate regulatory, ecological, and financial aspects of coastal wetland restoration.
- → **Adopt a participatory governance model** for coastal wetland restoration that includes a site-specific participatory committee and structured cooperation with ECoP to ensure inclusive decision-making grounded in best available scientific expertise and best practice exchange.

References

Ciobotaru, N., Laslo, L., Matei, M., Mușat, C., Lupei, T., Boboc, M., Deak, G. (2016). Mapping Romanian wetlands – A geographical analysis. 3rd International Conference Water resources and wetlands 3. 220-227. Available at: https://www.researchgate.net/publication/305277994_MAPPING_ROMANIAN_WETLANDS_-_A_GEOGRAPHICAL_APPROACH.

Conway, S. F. (2025). Multi-Actor Inclusion and Stakeholder Engagement Checklist – PREMIERE Toolsheet (Technical note). Zenodo. https://doi.org/10.5281/zenodo.15281085 .

DDBRA. (2025). Functional Areas. DDBRA. Available at: https://ddbra.ro/zonare-functionala/.

DDBRA. (n.d.). Despre rezervatie. DDBRA. Available at: https://ddbra.ro/prezentare-generala/ .

De Oliveira, M., Morrison, T., O'Brien, K. R., & Lovelock, C. E. (2024). Governance of coastal wetlands: Beyond the community conservation paradigm. Ocean & Coastal Management, 255, 107253. https://doi.org/10.1016/j.ocecoaman.2024.107253.

EC, Directorate-General for Agriculture and Rural Development. (n.d.). How can participatory methods enable communication and the embedding of the output from a multi-actor project? EU CAP Network. Available at: https://eu-cap-network.ec.europa.eu/projects/practice-abstracts/how-can-participatory-methods-enable-communication-and-embedding-output_en?utm_source=chatgpt.com.

European Commission & Ministry of Environment (Romania). (2019). Prioritised action framework for the Natura 2000 network in Romania 2021–2027. Available at: https://www.mmediu.ro/app/webroot/uploads/files/RO%20PAF.pdf.

European Commission. (2024). Romania – Final Updated NECP 2021-2030 (submitted in 2024). European Commission. https://commission.europa.eu/document/download/75df0ac2-ecf9-4212-89ac-2a603bd43e36_en?filename=RO_FINAL%20UPDATED%20NECP%202021-2030%20%28English%29.pdf.

Gâștescu, P. & Știucă, R. (2008). Delta Dunării. Rezervație a Biosferei, Edit. CDPress, București.

Matei, M., Laslo, L., Ciobotaru, N., Musat, C., Boboc, M., Raischi, M., & Gyorgy, D. (2016). Assessment of pressures caused by climate change on wetlands in Romania based on the MAES framework. International Journal of Environmental Science, 1, 265-271. Available at: https://www.iaras.org/journals/caijes/assessment-of-pressures-caused-by-climate-changes-on-wetlands-in-romania-based-on-maes-framework.

Ostrom, E. (2011). Background on the institutional analysis and development framework. In M. Poteete, A. Janssen, & E. Ostrom, Working together: Collective action, the commons, and multiple methods in practice (pp. 7–27). Princeton University Press. Available at: https://idahoecosystems.org/sites/default/files/literature_resource/sustainable_social-ecological_systems_ostrom_2011.pdf.

Ramsar Convention. (1971). Convention on Wetlands of International Importance especially as Waterfowl Habitat (Art. 1). Ramsar, Iran. Available at: https://www.ramsar.org/sites/default/files/documents/library/current_convention_text_e.pdf.

RESTORE4Cs. (2025). Danube Delta. RESTORE4Cs project. Available at: https://www.restore4cs.eu/case-pilots/danube-delta/ .

Romania´s Ministry of Regional Development and Public Administration. (2016). Integrated Sustainable Development Strategy for the Danube Delta. Ministry of Regional Development and Public Administration. Available at: https://www.mdlpa.ro/uploads/articole/attachments/5dc54f4615388605628193.pdf.

Seceleanu-Odor, D., Burada, A., Despina, C., Teodorof, L., Țigănuș, M., Tudor, I.-M., Ibram, O., Spiridon, C., & Tudor, M. (2018). Time evolution of water quality parameters in the Razim-Sinoe aquatic complex (Romania) 1991–2017. In Deltas and Wetlands Book of Abstracts. Danube Delta National Institute for Research and Development.

Terisse, A. et al. (2023). Characterising supportive governance and policy. Deliverable. WaterLands. Available at: https://cdn.sanity.io/files/34jdpbeg/production/5998e2ff94dad02b23da477813737a84c763070a.pdf .

Török, Z. (2002). The Romanian wetland inventory project. Scientific Annals, 9. 161-173.

UNEA. (2022). Nature-based solutions for supporting sustainable development. United Nations Environment Resolution UNEP/EA.5/Res.5. Available at: https://wedocs.unep.org/rest/api/core/bitstreams/4caa2911-37ea-4915-b378-d2c2d525ee35/content.

RESTORE4Cs Products

Anglada, C., Massoutier, J., Lago, M., Ciravegna, E., Raoult, J., Polman, N., Bodivit, A., Sella, L., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Bučas, M., Beekman, V., Geamana, N., Giuca, R.C., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M.J., Morant, D., Rota, F.S., Štrbenac, A., Oliveira, B., & Lillebø, A. (2025). Report on cost/benefit analysis of wetland restoration options and on financing tools. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).

Kampa, E., Bueb, B., Elkina, E., Otero, M.M., Abdul Malak, D., Schröder, C., Sanchez, A., Guelmami, A., Ronse, M., Kataržytė, M., Vaičiūtė, D., Bučas, M., Raoult, J., Speijer, F., Lillebø, A., Carvalho, T., Geamănaă, N., Cazacu, C., Racoviceanu, T., & Camacho, A. (2024). Policy analysis and policy demands for data, methods, and tools (Part A). Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP1 – Policy Relevance).

Otero, M. M., Abdul Malak, D., Sanchez A., Schröder, C., Kampa, E., Bueb B., Elkina, E., Guelmami, A.,Camacho, A., Marangui, C., Lillebø, A. (2025). European Coastal Wetland Indicators: A proposal for monitoring policy process across space and time. Policy brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/12/EN_Policy-Brief-6-v2_Final.pdf.

Otero, M., Camacho, A., Abdul Malak, D., Kampa, E., Scheid, A., & Elkina, E. (2024). How can coastal wetlands help achieve EU climate goals? Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

Sella, L., Rota, F. S., Pollo, N., Vivaldo, G., Anglada, C., De Fusco, G., Ciravegna, E., Massoutier, J., Bodivit, A., Khavandgaran, S., Omidmand, M., Ronse, M., Guelmami, A., Vaičiūtė, D., Petkuvienė, J., Kataržytė, M., Beekman, V., Polman, N., Raoult, J., Giuca, R. C., Geamana, N., Cazacu, C., Suarez, S., Rochera, C., Picó Garcés, M. J., Morant, D., Štrbenac, A., Lillebø, A., Sousa, A., Coelho, P., & Oliveira, B. (2025). Social acceptability of wetland restoration and management. Deliverable. RESTORE4Cs project. Available at: https://www.restore4cs.eu/about/workplan/ (under WP5 – Social, ecologic, and economic valuation for enhanced co-benefits from wetland restoration).