

Restoring Coastal Wetlands in Europe

Pilot roadmap on coastal wetland
restoration in Portugal

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



Partners



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 **wEt**lands for **Car**bon pathways, **Cl**imate **Ch**ange mitigation and adaptation, ecosystem services, and biodiversity, **Co**-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 (Curoonian 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
CH₄	Methane
CLC	CORINE Land Cover
CO₂	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
N₂O	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 phreatophytic 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.

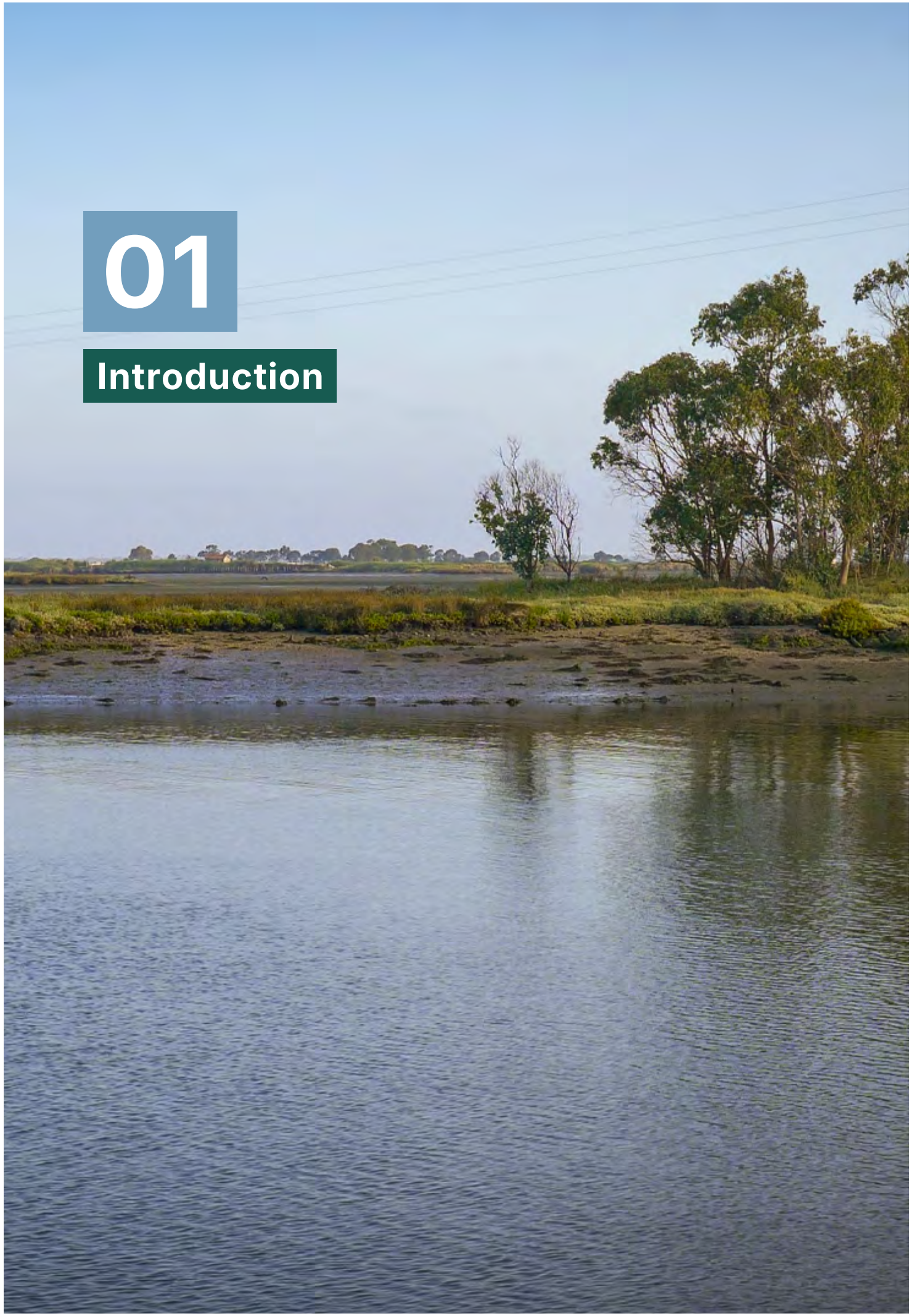
2 Otero, M. et al. (2024). *How can coastal wetlands help achieve EU climate goals?* Policy Brief. RESTORE4Cs project. Available at: https://www.restore4cs.eu/wp-content/uploads/2025/09/RESTORE4Cs_Policy-Brief-1_EN.pdf.

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 adaptation⁴. When restored, they act as nature-based solutions: reducing greenhouse gas emissions (GHG), removing CO₂ from the atmosphere⁵, 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 emissions⁶. 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 then 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.

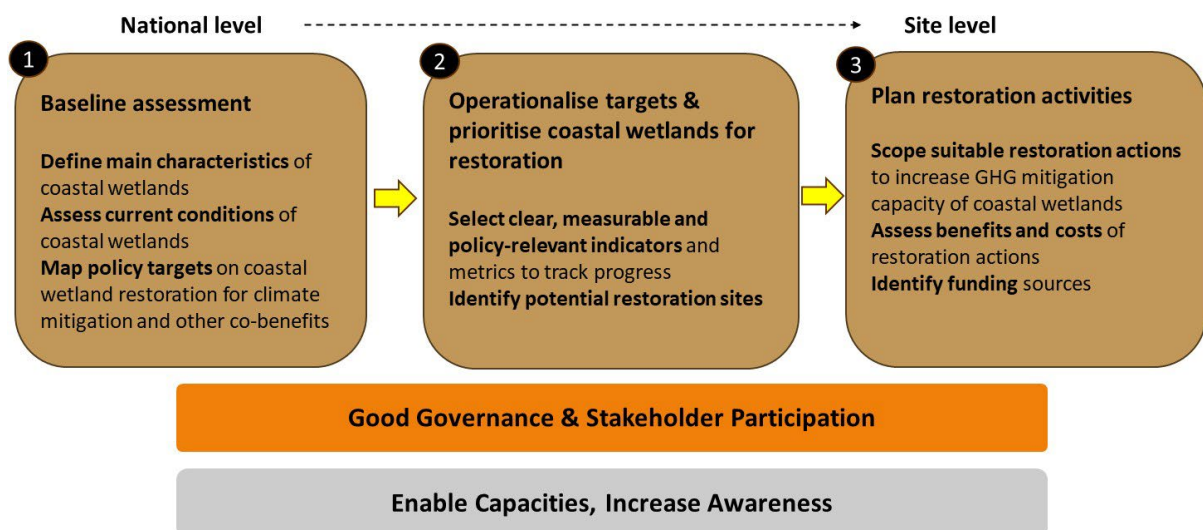


Figure 1: Structure of pilot roadmap for Portugal.



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*	<p>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.</p> <p>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.</p>	<p>APA official website https://apambiente.pt/</p> <p>*Ramsar official website https://rsis.ramsar.org/</p>
ICNF	References both the Ramsar Convention definition and the EU Habitats Directive typology	<p>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.</p> <p>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.</p>	<p>ICNF official website https://www.icnf.pt/</p>

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 artificial 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 km², at least 591,91 km² 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 – POC¹⁰ (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-orka-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 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](#).



Extended Wetland Layer 2018

- Inland marshes
- Beaches, dunes, sand
- Coastal lagoons
- Coastal saltpans (highly artificial salinas)
- Intertidal flats
- Lakes, ponds and reservoirs
- Managed or grazed wet meadow or pasture
- Marine waters less than six metres deep at low tide
- Natural seasonally or permanently wet grasslands
- No Wetland
- Open mires
- Rice Fields
- Riparian, fluvial and mixed forest
- Riparian, fluvial and swamp broadleaved forest
- Riparian, fluvial and swamp coniferous forest
- River estuaries and estuarine waters of deltas
- Riverine and fen scrubs
- Salt marshes
- Water courses
- Wet heaths

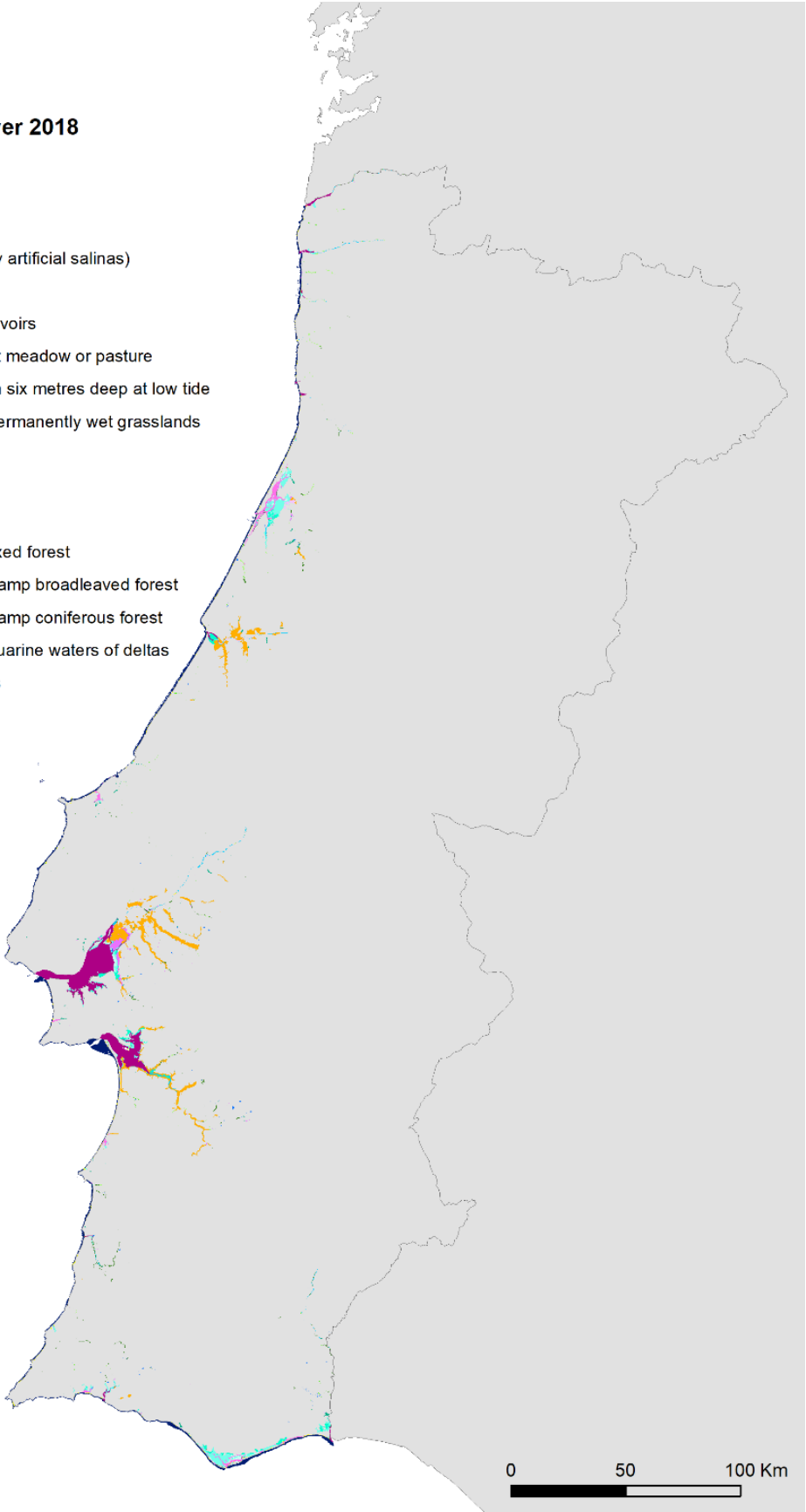


Figure 2: Map on extent of coastal wetlands in Portugal. Source: Policy Progress tracking tool on the European Coastal Wetlands Interactive Platform (based on extended Wetland Layer).

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 available¹¹. The latest available summary report¹² and associated data set¹³, 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 442/2025/1¹⁴ 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. Diário da Republica. No. 239. 12-12-2025.
<https://files.diariodarepublica.pt/1s/2025/12/23900/0001000012.pdf>.



Wetlands area covered by Natura 2000

- Green Good
- Grey No data
- Red Bad

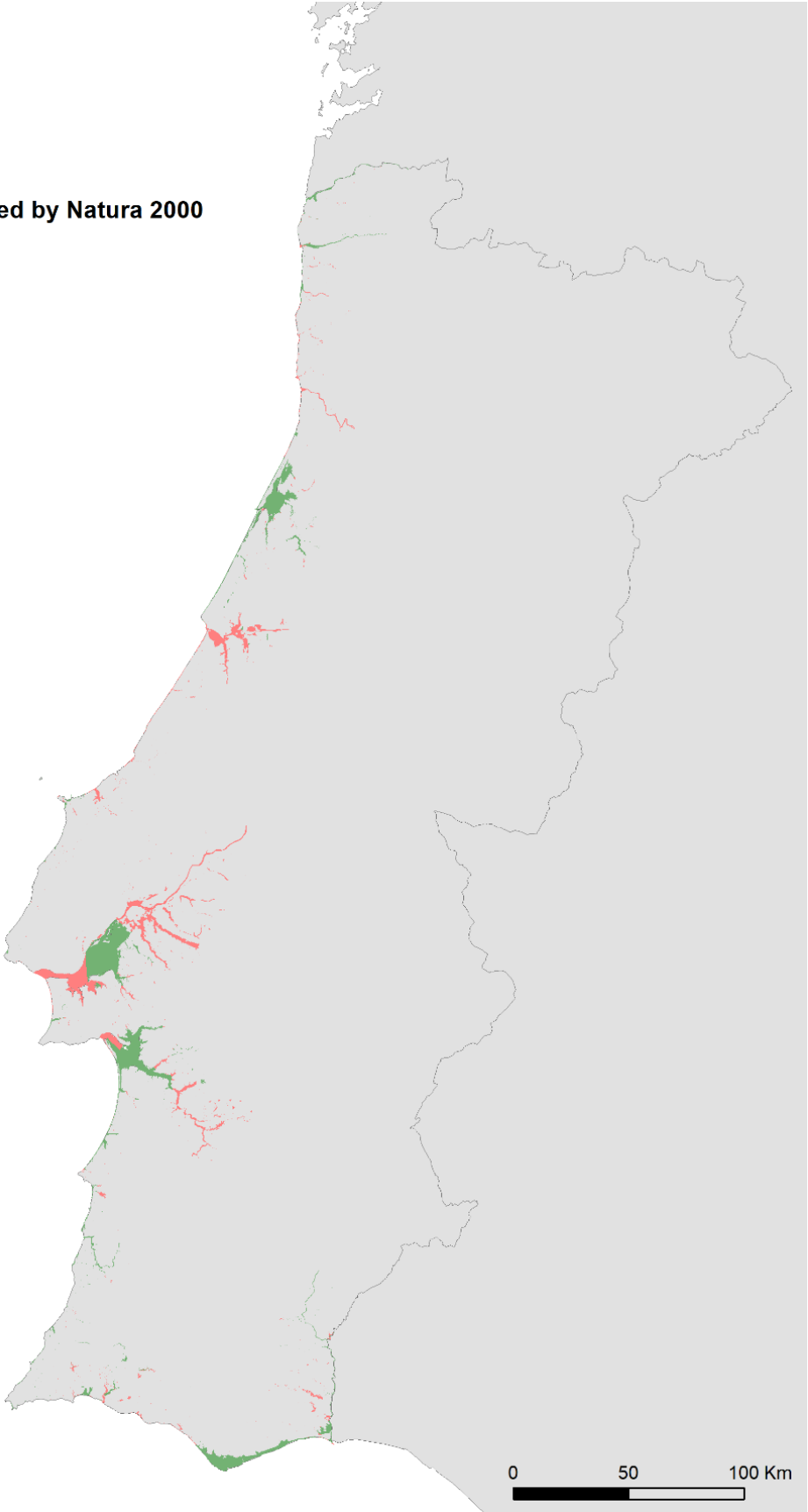


Figure 3: Coastal wetlands area covered by Natura 2000 (2023) (Green colour (Good)=Wetland protected by Natura 2000; Red colour (Bad)=Wetland not protected by Natura 2000). Source: Extent and Condition Indicators Tool on the European Coastal Wetlands Interactive Platform.



Wetlands area covered by Nationally Designated Areas

- Good
- No data
- Bad

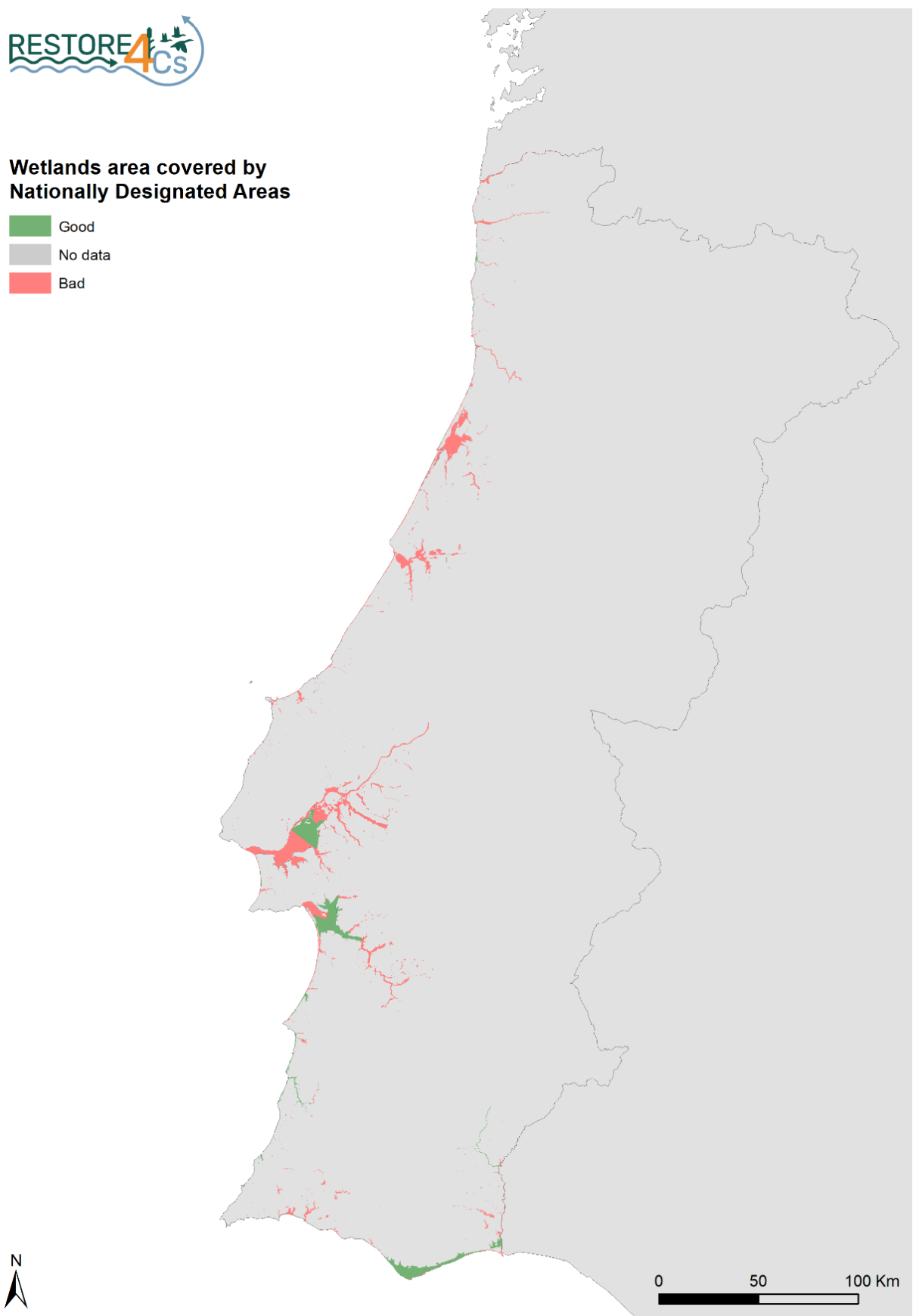


Figure 4: Coastal wetlands area covered by Nationally Designated protected areas (Green colour (Good)=Wetland protected by national designated areas; Red colour (Bad)=Wetland not protected by national designated areas). Source: Extent and Condition Indicators Tool on the European Coastal Wetlands Interactive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



Percentage of wetland birds with increasing or stable population trends (short term)

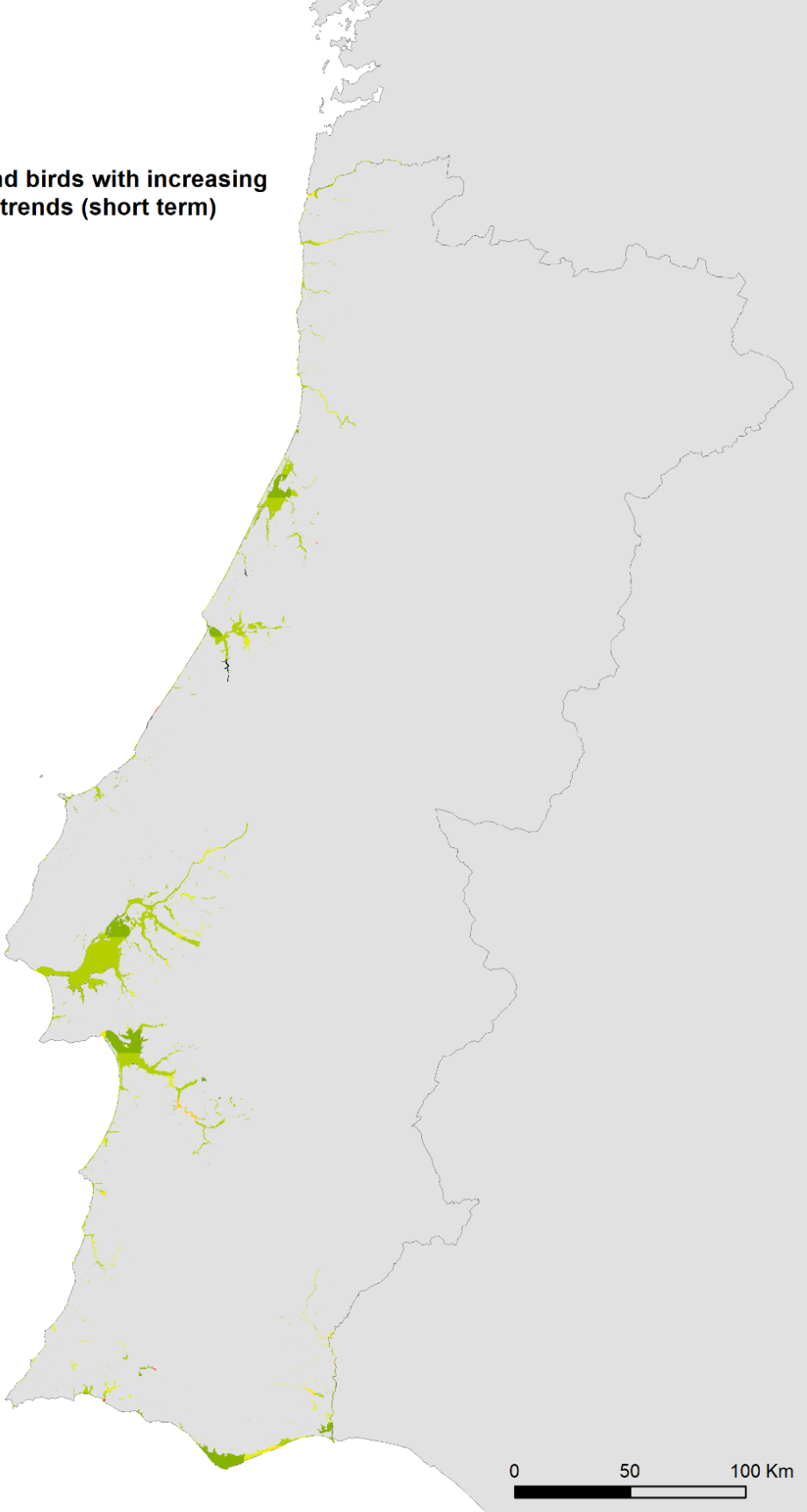
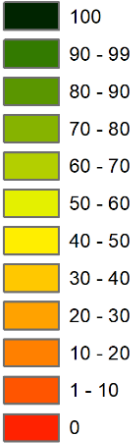


Figure 5: Percentage of Wetland Birds with Increasing or stable population trends (short term) in Portugal mainland (2018). Source: University of Malaga.



Percentage of wetland birds with increasing or stable population trends (short term)

- Good
- No data
- Bad

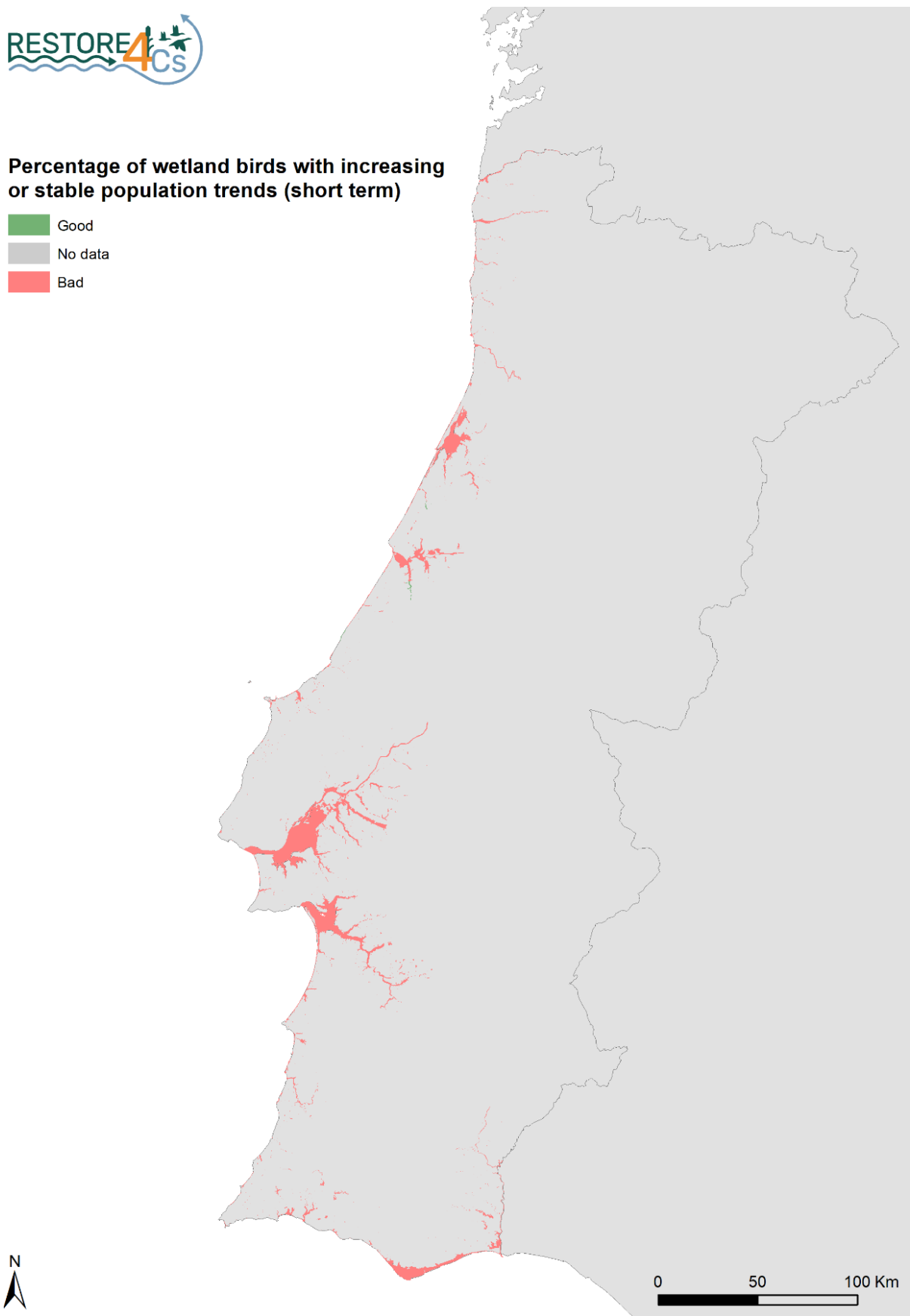


Figure 6: Percentage of wetland birds with increasing or stable population trends (short term) in Portugal mainland (2018). Source: University of Malaga.

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-orka-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-orka-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-orka-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-orka-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-orka-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 Law¹⁵ (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 (ENAAAC)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 Preservation²⁰ (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 Fauna²³ (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 areas** 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 Network²⁶ (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 municipalities²⁷ 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 Law²⁸ (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 Plan²⁹** 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 Plans³⁰** – 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 ecosystems³¹.

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)	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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 included³⁶.
- 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 Portugal'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 (km ²)	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 (km ²)	Extent of coastal wetlands within the Natura 2000 network.
	Total Coastal Wetland Extent designated as Ramsar and/in Natura 2000	Area Coverage (km ²)	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 (km ²)	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 (km ²)	Coastal wetland extent data by habitat type (e.g., salt marshes, mudflats).
	Individual Coastal Wetland Habitat Extent in Natura 2000	Area Coverage (km ²)	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.
	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 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 Sequestration 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	% / km ²	No data
	Total coastal wetland extent in Natura 2000 sites	% / km ²	58.26% – Area: 951.39 km² (Reference year: 2023)
	Total coastal wetland extent designated as Ramsar and part of the Natura 2000 network	% / km ²	28.03% – Area: 457.77 km² (Reference year: 2025)
	Total coastal wetland protected as Nationally Designated Area	% / km ²	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.

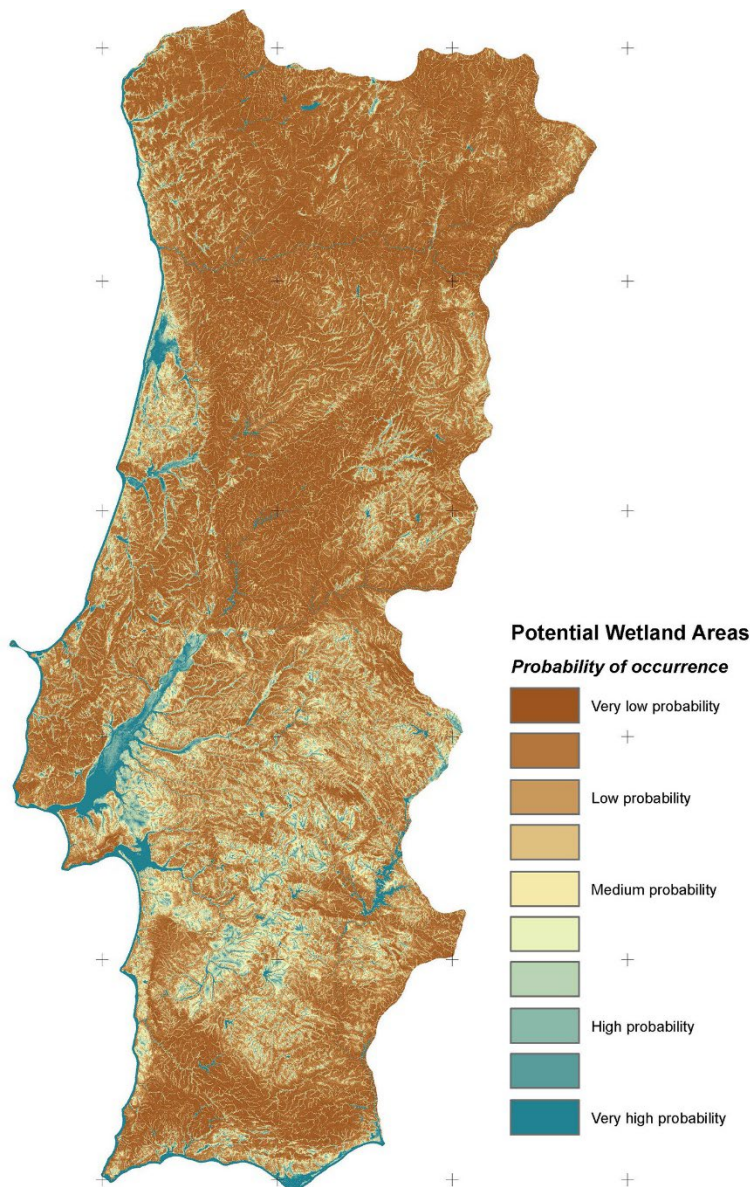


Figure 7: Probability of Potential Wetland Areas (PWA) Across Mainland Portugal. Source: Spatial Decision-Support Toolbox on the [RESTORE4Cs European Coastal Wetlands Interactive Platform](#).

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.

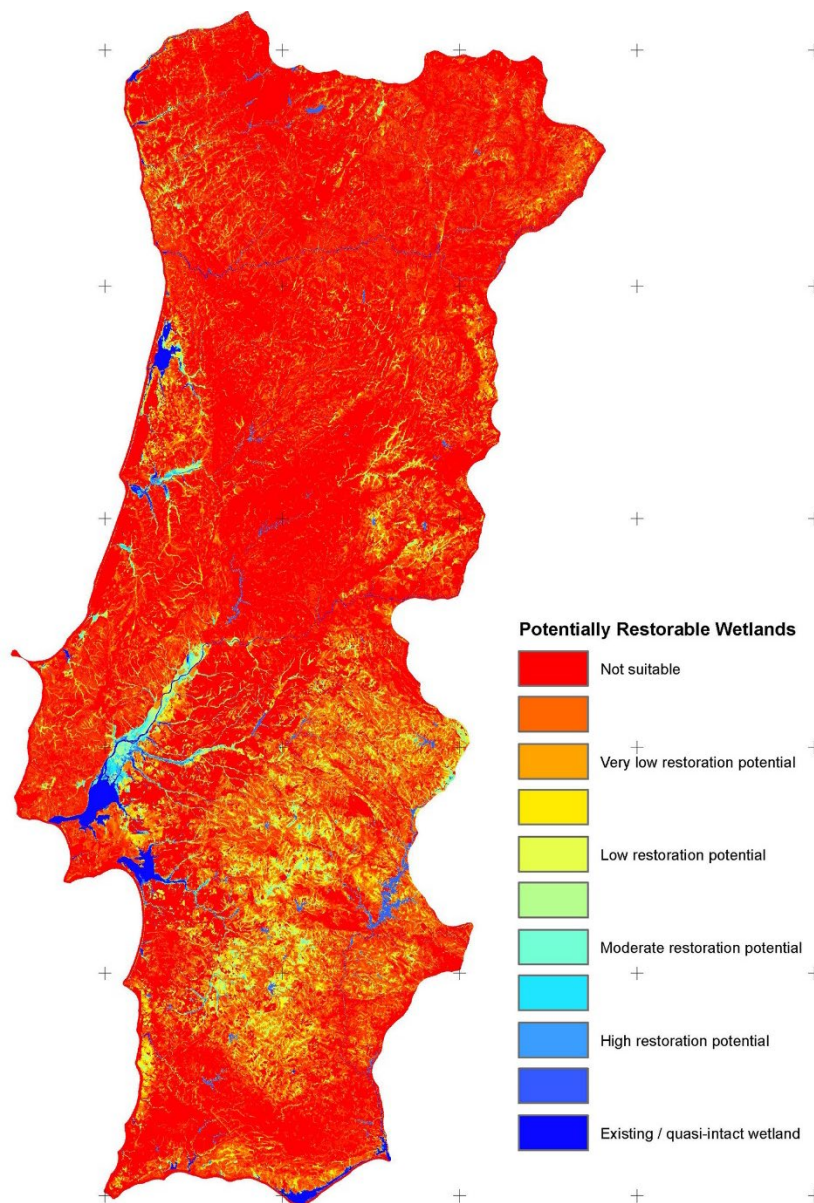


Figure 8: Potentially Restorable Wetlands (PRW) and Restoration Suitability in Mainland Portugal. Source: Spatial Decision-Support Toolbox on the [RESTORE4Cs European Coastal Wetlands Interactive Platform](#).

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 Portugal³⁷, Scientific Report I: Assessment of blue carbon ecosystems in mainland Portugal³⁸, Scientific Report II: Assessment of blue carbon ecosystems in mainland Portugal³⁹ 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 CO₂ and N₂O, 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 (CH₄) and nitrous oxide (N₂O) 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 indicators⁴⁰. Previous reports often lacked empirical data on CO₂, CH₄, and N₂O 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 CO₂ uptake and CH₄ 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 CH₄ and N₂O emissions compared to degraded sites. CO₂ 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 consequences⁴¹. 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>.

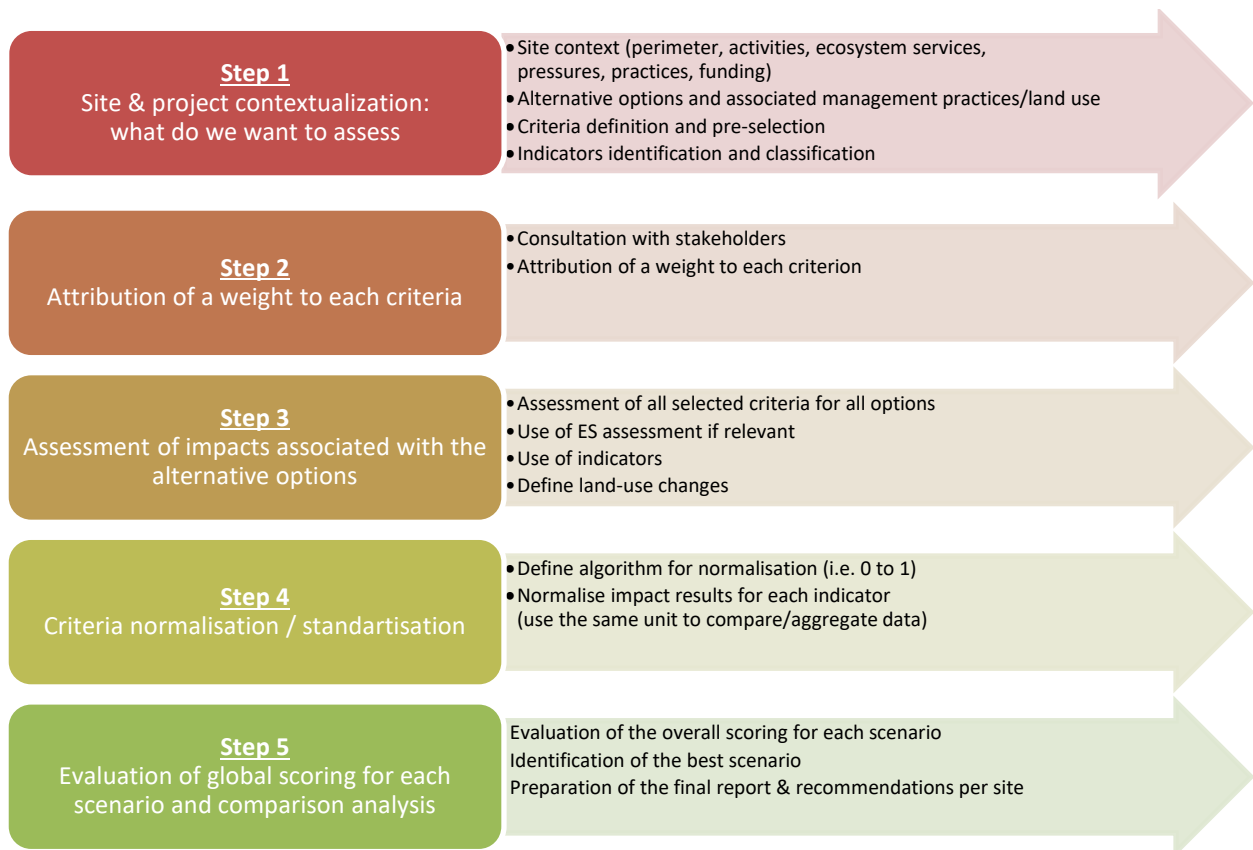


Figure 9: MCA Methodology steps applied to RESTORE4Cs sites. Source: Anglada et al. 2025.

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 workshops⁴² took place with 29 local stakeholders⁴³ 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 underfunded⁴⁵. 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 model⁴⁶, national voluntary carbon market⁴⁷). Although some private companies have shown interest in offsetting part of their GHG emissions through blue carbon projects as well⁴⁸, 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 complementary 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 project⁴⁹.
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 stakeholders⁵⁰, 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 ecosystems⁵¹.

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	<p>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.</p> <p>These instruments create enabling environment for public-private partnerships.</p>	<p>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 stakeholders⁵², these instruments are expected to be socially acceptable within the Portuguese context.</p>
PES (e.g., biodiversity offset markets, blue carbon markets)	<p>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.</p> <p>These instruments create enabling environment for public-private partnerships.</p>	<p>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.</p> <p>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 project⁵³).</p>
Community and local business engagement	<p>This instrument can both generate revenue and enhance public stewardship especially in promoting eco-tourism, nature-based education, and low-impact economic activities.</p>	<p>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.</p>

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 parishes⁵⁴, 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 challenges⁵⁵. 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Enforcement of measures related to coastal wetlands. • Responsible for coast guard duties.
National Environmental Police	<ul style="list-style-type: none"> • Enforcement of measures related to coastal wetlands. • Prevention and repressing of the infringements to the environment.
Subnational level	
Intermunicipal Community Councils	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 nature-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, Italy²⁰, 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) focusing 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.

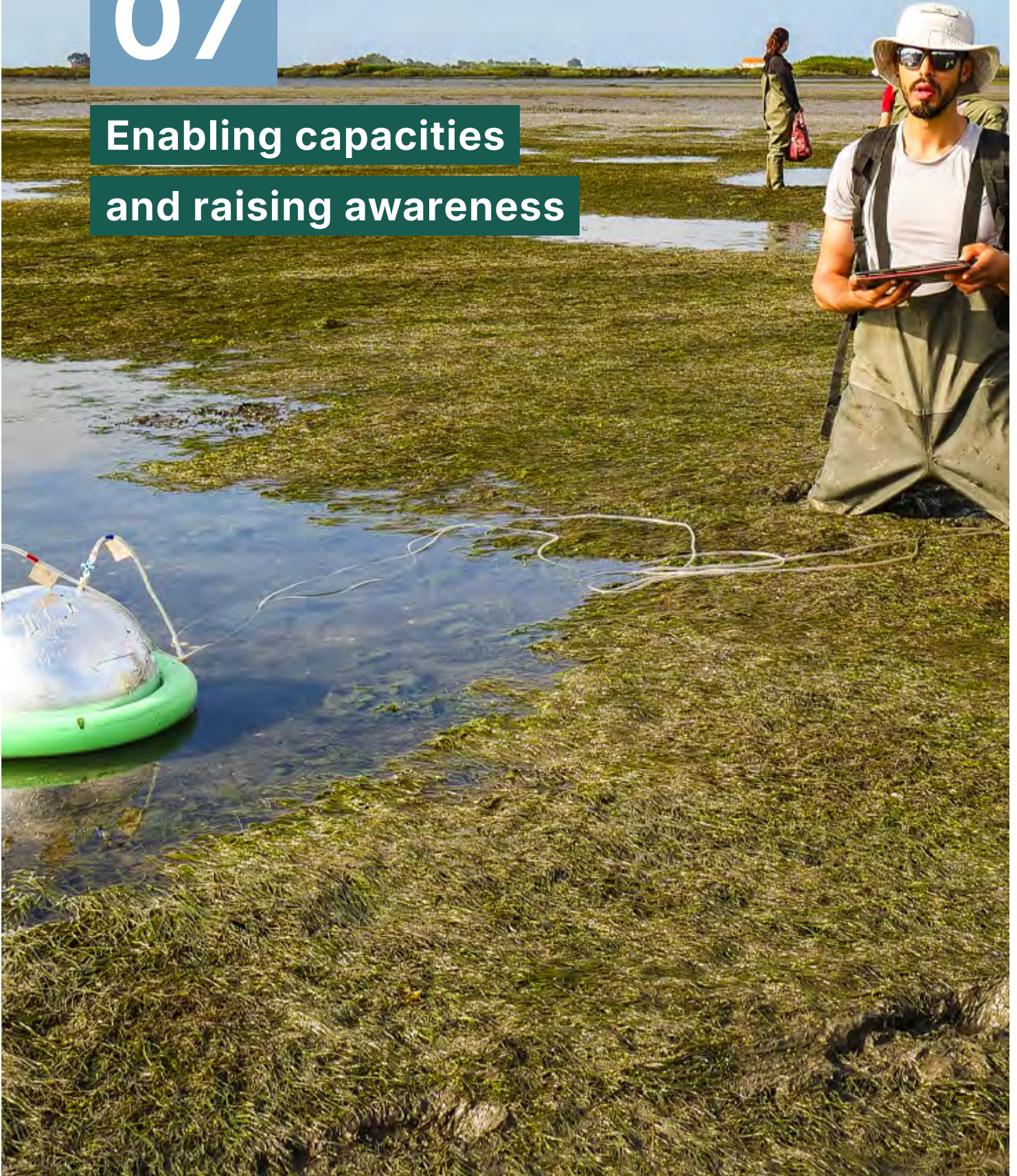
Key recommendations

- 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 viability⁵⁷. 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/mites/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, Lidia 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).

