

Pathways and opportunities for a better policy integration of Blue Carbon Ecosystems under the EU LULUCF Regulation



Suggested reference

Lindemann, C., Trubbach, S., Apostolaki, ET., Sæveld, M.H., Kennedy, H. (2026). JPI Oceans Blue Carbon Knowledge Hub. Pathways and opportunities for a better policy integration of Blue Carbon Ecosystems under the EU LULUCF Regulation. Brussels, Belgium.

Acknowledgments

This document was developed by the policy group of the JPI Oceans Blue Carbon Knowledge Hub, by Christian Lindemann (Norwegian Institute for Water Research), Saskia Trubbach (Norwegian Institute for Water Research), Eugenia Apostolaki (Hellenic Centre for Marine Research), Maren Helene Sæveld (Norwegian Institute for Water Research) and Hilary Kennedy (Bangor University). Further contributions were made by Samuel Henry (Agence Française de Développement), Ian Shepard (DG MARE, EC) and Solrun Figenschau Skjellum (NIVA), with support for this publication provided by Majbritt Bolton-Warberg (Marine Institute) and Gabrielle Aubert (JPI Oceans Secretariat). Design and layout by Lisa Picatto (JPI Oceans Secretariat).

The JPI Oceans “Blue Carbon” Knowledge Hub is led by Ireland, with Germany, Greece, Malta, Norway, Portugal and the United Kingdom as participating countries.



Table of contents

	Abbreviations	05
	Key recommendations	07
01	Background	09
02	Policy context	13
03	The LULUCF Regulation and blue carbon reporting in international climate policy	17
	3.1 The EU LULUCF Regulation: overview and policy context	19
	3.2 Existing guidelines and practices for reporting on blue carbon	22
	3.3 European case studies towards voluntary inclusion of blue carbon into Greenhouse Gas Inventories	28
04	Policy recommendations in a national and European context	33
	4.1 Build capacity and integrate blue carbon knowledge and data	34
	4.2 Align research and innovation with policy needs	36
	4.3 Enhance the availability of activity data through standardised monitoring and reporting	36
	4.4 Increase the evidence base and application of emission factors	37
	4.5 Develop EU-wide and national Blue Carbon strategies	38
	4.6 Mobilising public funding and private financing for blue carbon	39
05	References	43



Abbreviations

AFOLU	Agriculture, Forestry, and Other Land Use
CAP	Common Agriculture Policy
CRCF	EU Carbon Removal Certification Framework
EC	European Commission
EU	European Union
FAIR	Findable, Accessible, Interoperable, and Reusable
GHG	Greenhouse gas
GHGI	Greenhouse Gas Inventory
IPBC	International Partnership for Blue Carbon
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land use, land-use change, and forestry
MHW	Mean High Water
NECP	National Energy and Climate Plan
SDG	Sustainable Development Goal
TACCC	Transparency, Accuracy, Completeness, Consistency, and Comparability
UNFCCC	United Nations Framework Convention on Climate Change
UKBCEP	UK Blue Carbon Evidence Partnership
WAM	With Additional Measures

Key Recommendations

1. Establish an EU knowledge hub for blue carbon data and policy

An EU-level hub should be established to ensure that the existing and growing body of blue carbon research is effectively translated into policy. This mechanism should harmonise data collection and reporting, improve coordination between compilers, national authorities, researchers and European countries, and ensure compliance with FAIR and IPCC principles to strengthen the integration of blue carbon into climate and biodiversity frameworks.

2. Strengthen technical capacity and knowledge exchange, including emerging systems

Technical training, data sharing, and structured exchanges between European countries should be expanded to enhance capacity for blue carbon monitoring and reporting. Leveraging existing international partnerships will facilitate learning and allow flexibility for the inclusion of emerging blue carbon ecosystems.

3. Embed policy objectives and stakeholder engagement in research

Policy objectives and stakeholder consultations should be embedded from the outset of research projects to ensure that outputs consider reporting requirements and hence are relevant and usable for decision-making. This approach will increase the policy impact of research and support the inclusion of blue carbon ecosystems in national greenhouse gas inventories.

4. Standardise inventory compilation and ecosystem classification

The use of 2013 IPCC Wetlands Supplement methodologies, consistent ecosystem classifications, and innovative monitoring technologies should be promoted to support the harmonisation of wetland definitions and improve comparability and accuracy of blue carbon data across European countries. This will strengthen the link between carbon accounting, ecosystem management, and policy implementation.

5. Improve emission factor accuracy through synthesis and research

Further research and synthesis efforts are needed to better understand how blue carbon ecosystems respond to human pressures and management interventions. Improving the accuracy of emission factors will reduce uncertainty and enhance the reliability of national reporting.

6. Apply Tier 1 values and progress toward higher tiers

European countries should apply Tier 1 default values as a starting point while progressively developing Tier 2 and Tier 3 methodologies at the EU level. This gradual approach will improve precision and harmonisation in greenhouse gas reporting over time.

7. Advance toward Tier 3 methodologies through harmonised datasets

Efforts should be made to increase policy support and develop harmonised national datasets and monitoring tools, supported by capacity building, technical training, and funding. This will enable European countries to transition towards more detailed Tier 3 methodologies in the long term.

8. Develop an EU-wide Blue Carbon Strategy

The EU should develop a dedicated Blue Carbon Strategy to align climate, biodiversity, and restoration policies under the Ocean Pact and forthcoming Ocean Act. Such a strategy could provide clear and actionable reporting frameworks across EU legislation and guide European countries in integrating blue carbon into the LULUCF Regulation and other relevant policies.

9. Adopt national Blue Carbon Strategies

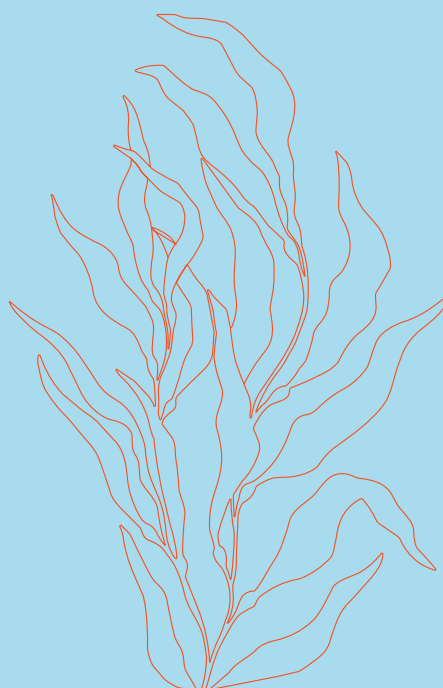
Each Member State should develop a national Blue Carbon Strategy outlining mitigation and adaptation policies and governance pathways for integrating blue carbon into national greenhouse gas inventories. These strategies should strengthen cross-sectoral coordination and identify funding and financing opportunities for restoration and conservation.

10. Align blue carbon methodologies with EU compliance frameworks

Blue carbon accounting methodologies should be aligned with EU compliance systems such as the LULUCF Regulation and the Carbon Removal Certification Framework. Ensuring methodological coherence between these instruments will build investor confidence, prevent double-counting, and support high-integrity restoration efforts.

11. Promote blended finance for blue carbon restoration

Public funding should be used strategically to de-risk early-stage blue carbon projects and attract private investment through blended finance models. These approaches can promote scalable restoration while ensuring long-term monitoring, compliance, and the generation of co-benefits such as biodiversity conservation and coastal protection.



Credit: Oleksandr Sushko / Unsplash



Background

The bottom half of the page features several thin, wavy, light orange lines that create a sense of movement and depth. These lines are layered behind the large '01' text.

01

1. Background

Europe's marine benthic habitats provide critical ecological functions: they serve as essential feeding and spawning grounds for numerous benthic species, and their protection is essential for tackling the marine biodiversity crisis. In addition, they support numerous ecosystem services, such as nutrient cycling, primary production, while also supporting fisheries and tourism. Amongst these services, benthic habitats have the potential to capture and store carbon – commonly referred to as 'blue carbon'.

The definition of '**blue carbon**' has evolved over time and in conjunction with scientific developments in the field. The Intergovernmental Panel on Climate Change (IPCC) defines it as "*biologically driven carbon fluxes and storage in marine systems that are amenable to management*". Whilst the broader meaning seems to refer to all marine, intertidal and estuarine carbon in all its forms, developments in ecological research have specifically tied the term to specific habitats and species – namely **seagrass meadows, salt marshes and mangrove forests** – due to their high carbon sequestration and storage potential and amenability for management action. These ecosystems are classified as 'coastal wetlands' in the Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands².

Recent developments in scientific and policy research are expanding this scope and the use of the term to incorporate other species and habitats (e.g. **macroalgae**) as blue carbon contributors. Efforts are also underway to further define the different carbon storage categories (e.g. vegetative biomass (above ground) and seafloor carbon pools (below ground))³.

The blue carbon discussion ultimately highlights the linkages between the management of the marine environment and climate mitigation. The carbon sequestration benefits of conserving and restoring⁴ blue carbon habitats are coupled to other climate related co-benefits, such as coastal protection from storm surges and erosion, and enhanced resilience to the impacts of ocean acidification. However, exposure to climate change factors can, in turn, influence the role of marine ecosystems in sequestering and storing blue carbon. The impact depends on the compartment affected (plant and/or soil/sediment), the frequency and intensity of those stressors, and the sensitivity and resistance, or resilience, of the ecosystem.

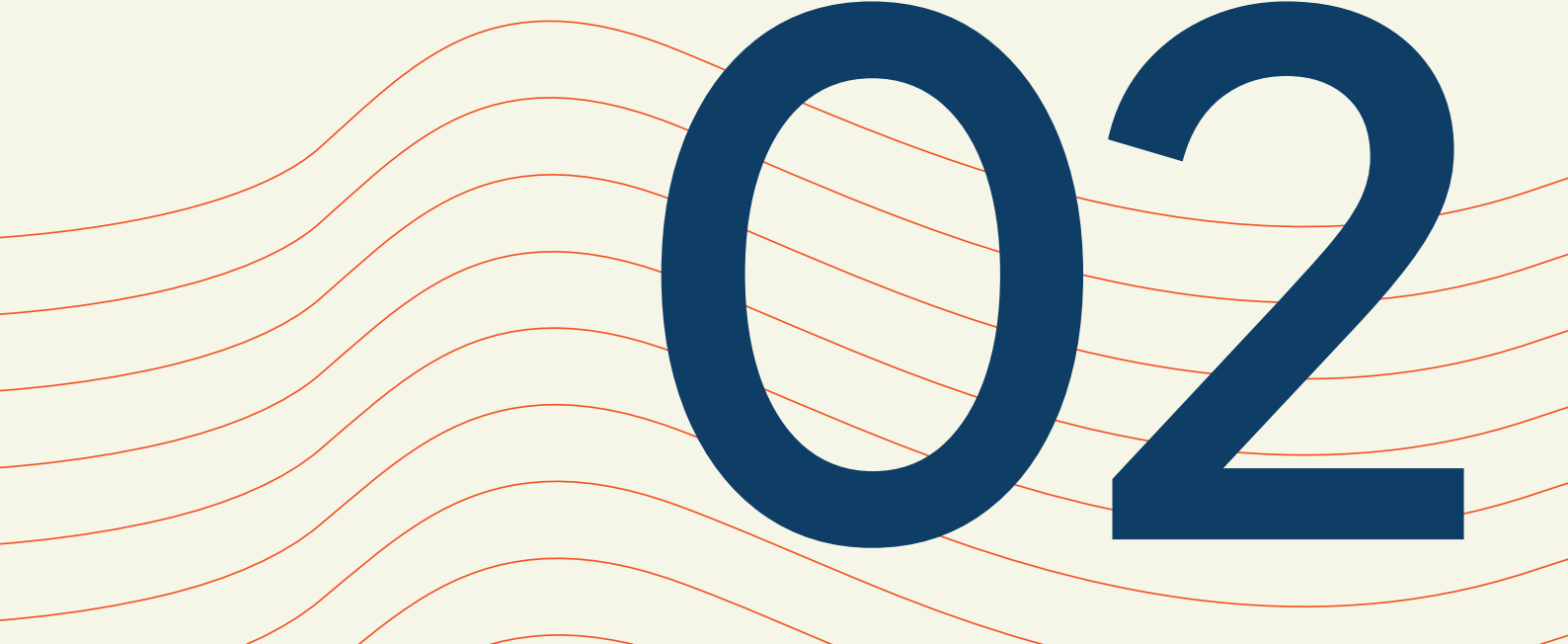
Considering these complexities and the potential for irreversible changes requires an adaptive decision-making process. While the conservation and restoration of coastal blue carbon ecosystems is included in climate strategies in other parts of the world⁵ and European funding for blue carbon research in Europe has increased⁶, these considerations remain insufficiently embedded in EU policy frameworks and tools. Substantial work is still needed to reflect the protection and restoration of blue carbon ecosystems and the enhancement of their storage capacity in relevant policy instruments, supported by actionable implementation pathways.



Credit: Anastassia Anufrieva / Unsplash



Policy Context

The bottom of the page features several thin, wavy, orange lines that create a sense of movement and depth. These lines are layered behind the large '02' text.

02

2. Policy Context

The protection and restoration of blue carbon ecosystems is supported by a growing number of international, EU and regional commitments. There is a growing acknowledgement of the value of these habitats for climate regulation across both biodiversity- and climate-related policy, as evidenced by:

- In the 2013 IPCC Wetlands Supplement the **United Nations Framework Convention on Climate Change (UNFCCC)** provides a methodology for estimating greenhouse gas (GHG) emissions and removals from wetland, providing an opportunity for including blue carbon into national climate change mitigation efforts and action plans.
- The **Kunming-Montreal Global Biodiversity Framework (KMGBF)**⁷, agreed in 2022, sets out an ambitious plan to bring about a transformation in our societies' relationship with biodiversity by 2030. It includes a specific target related to reducing climate change impacts on biodiversity and increasing resilience through mitigation, adaptation and disaster risk reduction actions, and provides an impetus for restoring blue carbon habitats⁸.
- The **EU Green Deal**⁹ has committed Europe to climate-neutrality by 2050, and its **related EU Biodiversity Strategy to 2030**¹⁰ has provided a commitment to restoring natural ecosystems including carbon rich habitats.
- The 2024 **EU Nature Restoration Regulation** recognises that *'restoring ecosystems also contributes to the Union's climate change mitigation and climate change adaptation objectives'* and includes quantitative and time-bound restoration targets for coastal and marine habitats amongst others¹¹.
- **Regional Seas Conventions (RSCs)** provide a mechanism for EU Member States to assess the marine environment and develop actions to protect it, in collaboration with neighbouring countries. RSCs are increasingly recognising the importance of action to preserve habitats and species not only for biodiversity but also for their essential role in carbon sequestration and storage, coastal protection and climate resilience. The Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (**Barcelona Convention**), the Convention for the Protection of the Marine Environment of the North-East Atlantic (**OSPAR Convention**), the Helsinki Convention on the protection of the Baltic Sea (**HELCOM**) and the Convention on the Protection of the Black Sea against Pollution (**Bucharest Convention**) all provide legal frameworks for regional cooperation and actions to consider climate change, with the integration of blue carbon under these frameworks now advanced to varying degrees.
- **The European Ocean Pact**¹², published in June 2025 by the European Commission, has announced support from the European Commission to develop new business models that benefit nature and people, including European blue carbon reserves and taking into account UNFCCC guidelines. It also announced an upcoming revision of the MSFD to accelerate progress towards the achievement of its environmental objectives, simplify implementation, and reduce administrative burden associated with reporting and data management.

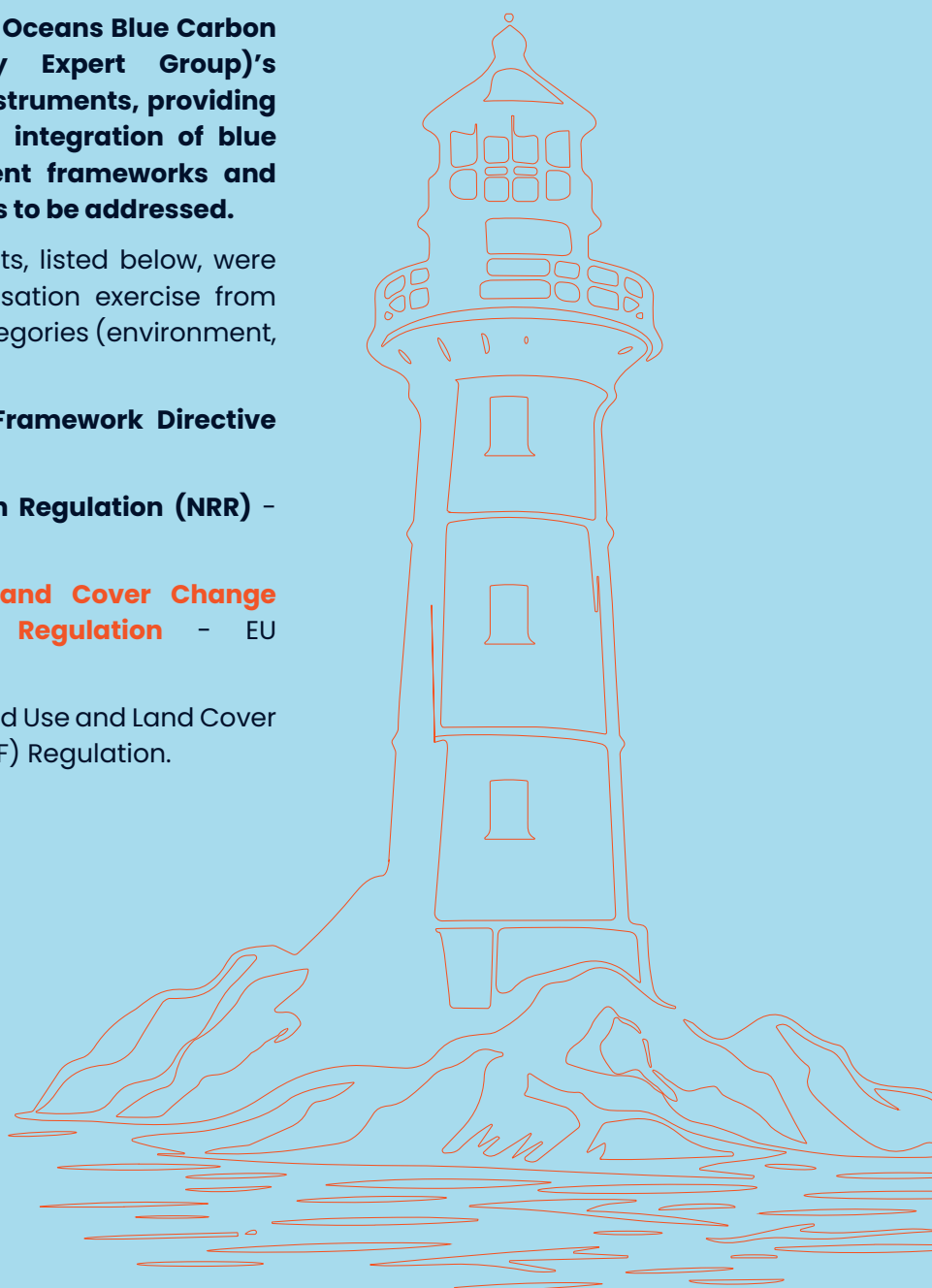
The intrinsic links between the biodiversity and climate crises and the intersection in policy ambitions to enhance blue carbon provide an opportunity to augment protection and restoration of these habitats through national, regional and EU action¹³. Nevertheless, the importance of blue carbon remains a subject of emerging relevance with space for improvement towards full reflection of its real potential within the current policy context.

Three briefs outline the **JPI Oceans Blue Carbon Knowledge Hub (Policy Expert Group)**'s **analysis of three policy instruments, providing recommendations on the integration of blue carbon within their current frameworks and identifying remaining gaps to be addressed.**

The three policy instruments, listed below, were selected through a prioritisation exercise from policies under the three categories (environment, biodiversity and climate):

- The **Marine Strategy Framework Directive (MSFD)** - 2008/56/EC
- The **Nature Restoration Regulation (NRR)** - EU Regulation 2024/1991
- The **Land Use and Land Cover Change Framework (LULUCF) Regulation** - EU Regulation 2018/841.

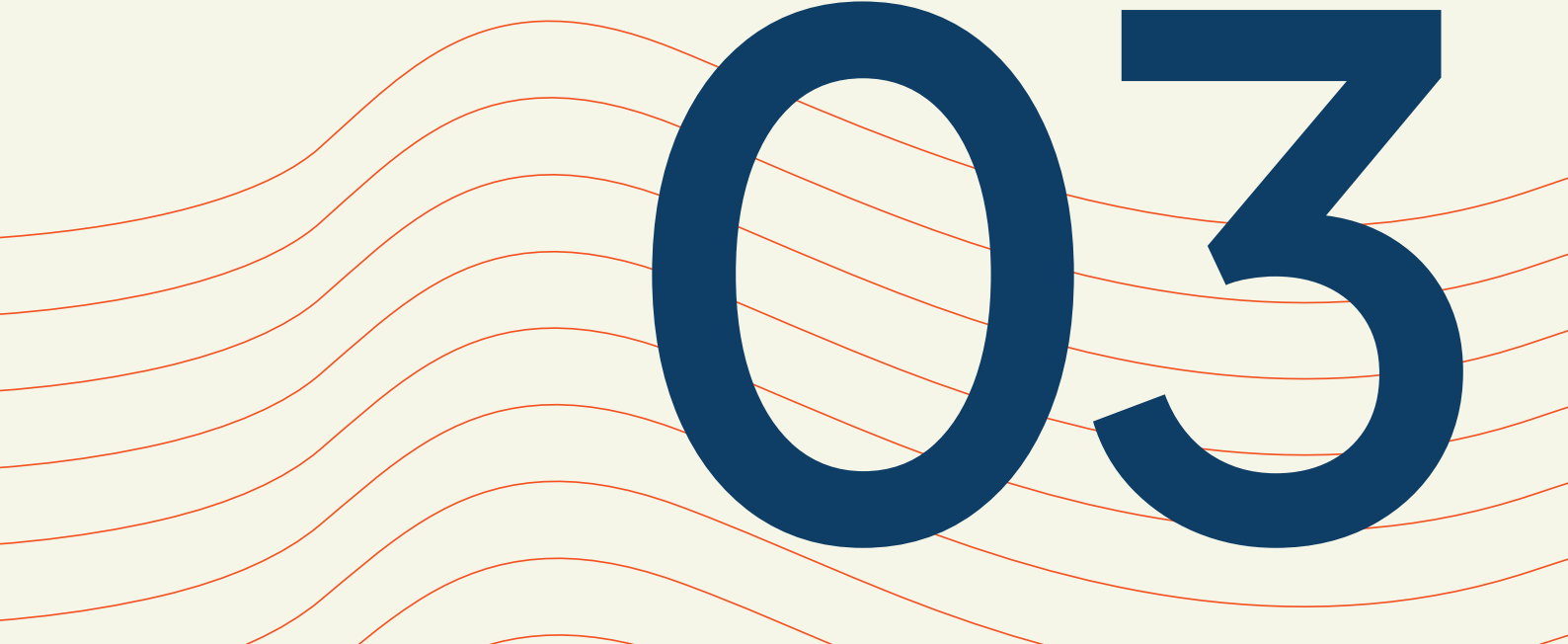
This brief focuses on the Land Use and Land Cover Change Framework (LULUCF) Regulation.



Credit: Michiel Vos / Ocean Image Bank



The LULUCF Regulation and blue carbon reporting in international climate policy

The bottom of the slide features several thin, wavy, orange lines that sweep across the width of the page, creating a sense of movement and depth.

03

3. The LULUCF Regulation and blue carbon reporting in international climate policy

3.1 The EU LULUCF Regulation: overview and policy context

The **European Climate Law**¹⁴ establishes legally binding targets for reducing greenhouse gas (GHG) emissions across the European Union (EU), to achieve climate neutrality by 2050. The 2030 climate target, which aims to reduce net GHG emissions by 55% compared to 1990, represents a shift from the 2020 approach by focusing on net emissions rather than solely on direct emission reductions. This means that GHG removals, particularly from **land use, land-use change, and forestry (LULUCF)**, are now accounted for alongside emission reductions. Enhancing natural carbon sinks is therefore critical to achieving the EU's climate objectives.

As part of the **'Fit for 55'** legislative package¹⁵, European energy and climate legislation was revised to align with the pathway set out by the European Climate Law. This includes increased ambition for carbon removals in the LULUCF sector. In 2021, the European Commission proposed a more ambitious revised EU LULUCF Regulation¹⁶, which was adopted in April 2023. Compared to the previous one¹⁷, the revised Regulation introduces measures aimed at increasing the carbon sink potential of land use and forestry to reverse the current trend of declining net removals in the LULUCF sector. The revised Regulation also includes simplified accounting rules, aligned with the reporting categories and obligations under the **United Nations Framework Convention on Climate Change (UNFCCC)**, which will apply from 2026. For 2030, the EU LULUCF Regulation sets a removal target of 310 MtCO₂eq, distributed in the form of annual targets between Member States¹⁸.

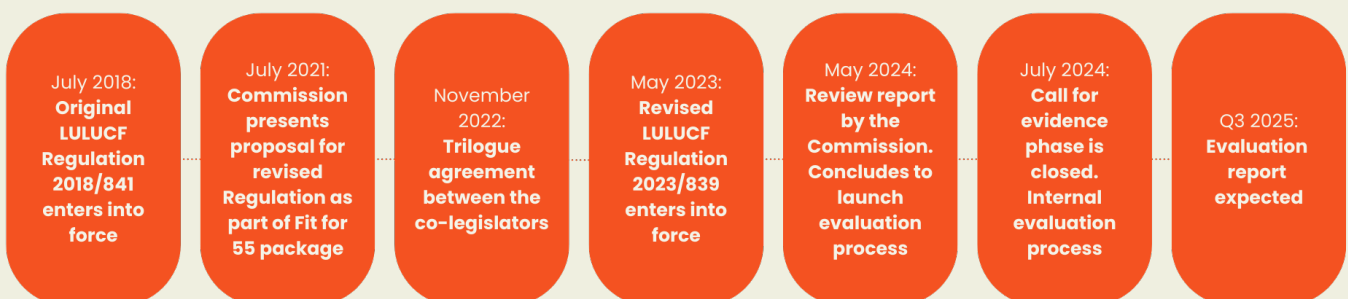


Figure 1: Timeline of the development of the EU LULUCF Regulation

“ How the EU LULUCF Regulation links to blue carbon ”

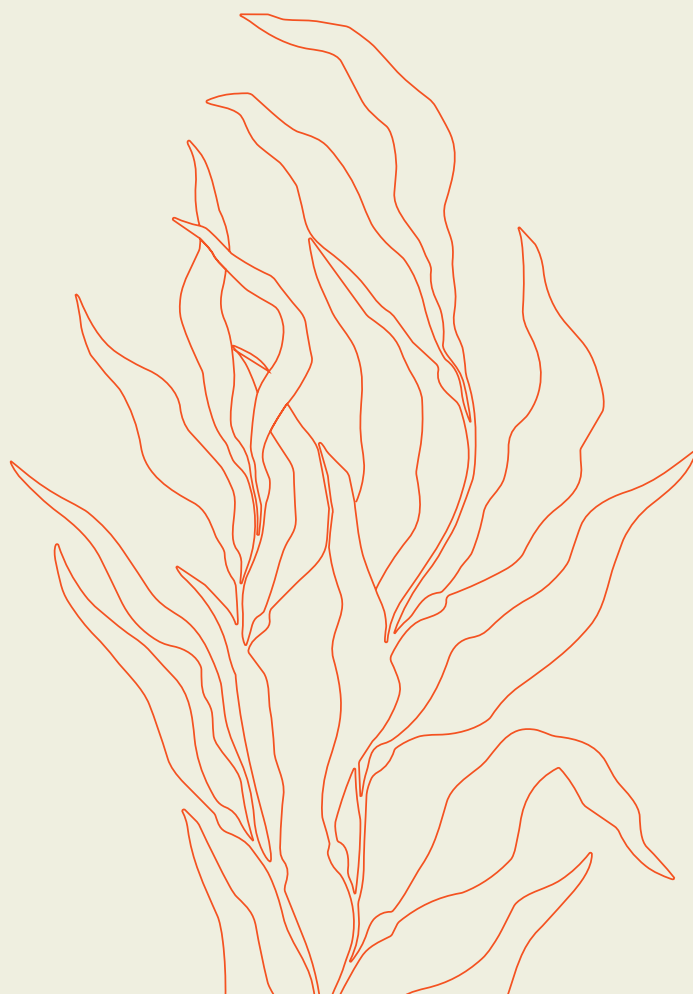
In the context of international climate policy, the term ‘blue carbon’ is frequently referred to as ‘**coastal wetland**’ in accordance with the reporting guidelines established by the **Intergovernmental Panel on Climate Change (IPCC)**. The EU LULUCF Regulation specifies that reporting for managed wetlands is voluntary for the period 2021–2025 but becomes mandatory from 2026 onwards. However, it is important to note that these mandatory obligations do not extend to coastal wetlands. As outlined in Annex V of the Regulation, monitoring and reporting in the EU LULUCF sector follows the 2006 IPCC Guidelines. Specific reporting rules for coastal wetlands, however, were only introduced later in the 2013 IPCC Wetlands Supplement.

The EU LULUCF Regulation does not explicitly mention the 2013 IPCC Wetlands Supplement, nor does it encourage EU Member States to include coastal wetlands explicitly in their GHG reporting.

However, European countries do have the option to include such reporting **voluntarily**. This is in alignment with the international reporting requirements to the UNFCCC, where reporting of coastal wetlands using the 2013 IPCC Wetlands Supplement also remains voluntary. This means that at present, **carbon emissions and removals from blue carbon ecosystems are not accounted for in the EU’s climate regulatory framework**¹⁹.

During the trilogue negotiations, the European Parliament proposed amendments to address blue carbon more explicitly, including calls for future inclusion and the application of ecosystem-specific emission targets²⁰. Although these amendments were watered down in the final text, the EU LULUCF Regulation acknowledges a **potential future inclusion**. Indeed, the European Commission was tasked to submit a review report that may consider reporting greenhouse gas emissions and removals for marine and freshwater environments²¹. However, this review, published in May 2024, did not address this inclusion²². Moreover, the review called for an evaluation of the Regulation, given that the data reported by EU Member States are currently not on track, but its scope does not explicitly mention the role of blue carbon. The European Commission was expected to report back in the third quarter of 2025 (see Figure 1).

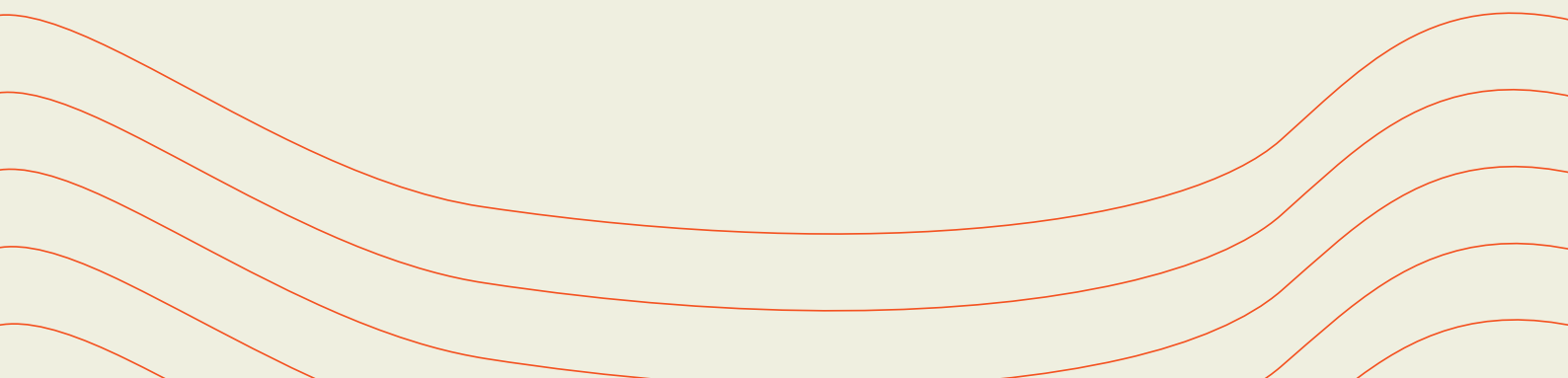
The EU LULUCF Regulation aims to account for the effects of sectoral activities on natural carbon sinks and enhance the land sector’s contribution to achieving climate targets. The targets set out in the EU LULUCF Regulation are a key instrument for improving land use across the EU, as they guide what EU Member States include in their National Energy and Climate Plans (NECPs) and Common Agriculture Policy (CAP) Strategic Plans. The currently **limited recognition of blue carbon ecosystems from the EU’s climate regulatory framework represents a significant policy gap**, as it hinders the recognition and incentivisation of carbon removals in these important ecosystems, for example, through enhanced protection and restoration efforts. Advancing and demonstrating the applicability of existing scientific knowledge of carbon fluxes in blue carbon ecosystems, alongside improvements in spatial mapping and accounting methodologies, is of high priority. This can both enhance voluntary reporting of European countries on blue carbon under the coastal wetlands reporting category and might, in the future, incentivise a revision and inclusion of blue carbon in the EU LULUCF Regulation.



Key summary points about the EU LULUCF Regulation:

- The EU LULUCF Regulation (2023/839) plays a key role in meeting the EU's increased climate goals by placing greater emphasis on enhancing carbon sinks in the land use sector.
- It aligns reporting practices with those of the UNFCCC and makes reporting for managed wetlands mandatory from 2026. This requirement does not apply to blue carbon (coastal wetlands).
- Reporting on blue carbon remains voluntary, in line with international obligations. The EU LULUCF Regulation does not explicitly reference the 2013 IPCC Wetlands Supplement, but European countries may choose to include it in their reporting on a voluntary basis.
- The EU LULUCF Regulation includes a review clause that allows for future consideration of coastal and marine ecosystems, depending on scientific and methodological developments. The Regulation is currently being evaluated by the European Commission..

Key recommendations for improved blue carbon integration in the Regulation:

- The European Commission should consider explicitly referencing the 2013 IPCC Wetlands Supplement in the Regulation and actively encourage European countries to incorporate it into their national GHG reporting.
 - The ongoing evaluation should explicitly consider the role of traditional, as well as emerging blue carbon ecosystems.
 - Although not currently emphasised in the EU LULUCF Regulation, European countries should be encouraged to report on blue carbon ecosystems under the coastal wetlands reporting category using the 2013 IPCC Wetlands Supplement, as several countries have already demonstrated that this is feasible.
- 



3.2 Existing guidelines and practices for reporting on blue carbon

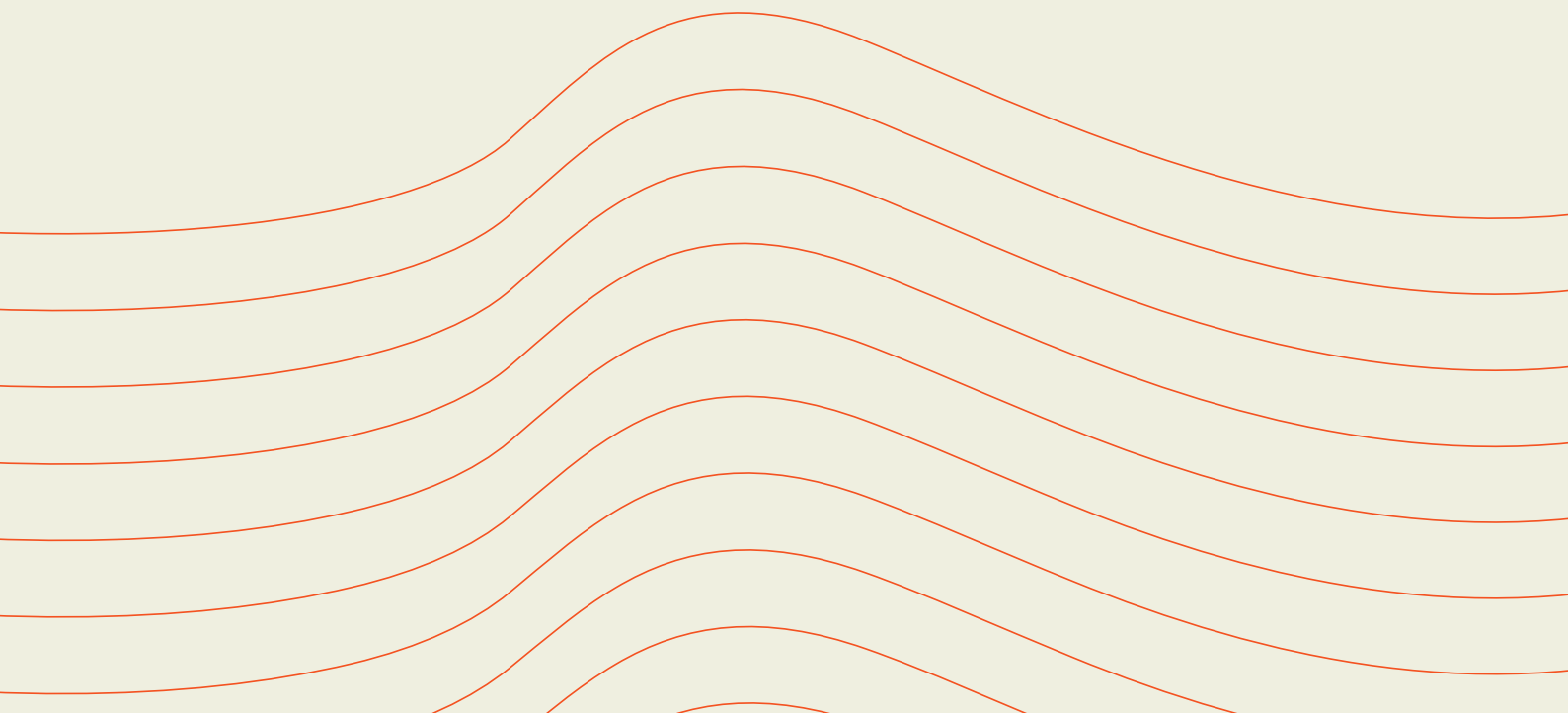
3.2.1 Relationship between the EU LULUCF Regulation and IPCC LULUCF frameworks

The monitoring and reporting requirements under the EU LULUCF Regulation are aligned with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (GHGI) submitted to the UNFCCC. GHGIs provide information about the level of emissions and removals across different sectors. National targets set under the EU LULUCF Regulation are based on historical data from these inventories and are assessed against annually reported emissions and removals. This reflects a **strong link between the EU LULUCF framework and the UNFCCC reporting system**, as the EU's targets and compliance assessments build on the same inventory infrastructure used to track progress under the Paris Agreement.

While the EU LULUCF Regulation only mandates the application of the 2006 IPCC Guidelines, which excludes blue carbon ecosystems, European countries can voluntarily report on these carbon-rich ecosystems by applying the 2013 IPCC Wetlands Supplement. An overview and current reporting practices pursuant to these Guidelines are presented below.

3.2.2 Introduction to IPCC guidance for greenhouse gas inventories

The 2013 IPCC Wetlands Supplement provides guidance for countries on how to include blue carbon ecosystems (termed 'coastal wetlands' in the IPCC) in their GHGIs. At present, coastal wetlands are represented by **mangrove forests, seagrass meadows, tidal freshwater, and salt marshes** (the latter two ecosystems subsequently referred to as "salt marsh"). The chapter addresses how human activities, subsequently referred to as management activities in-line with IPCC terminology, in these ecosystems influence greenhouse gas (GHG) emissions and removals, and offers methodological guidance on how to account for emissions and removals using standardised methods that ensure consistency across national inventories. The guidance focuses on a limited set of management activities that can result in land-use change. The methodologies allow countries to select the most suitable approach depending on the information, resources, and capacity available to them for developing a comprehensive inventory.



The IPCC advocates for the quantification of emissions and removals by **assessing changes across five carbon pools**: aboveground biomass, belowground biomass, dead wood, litter and soil organic carbon. For seagrass meadows and salt marshes, changes in the soil organic carbon pool (organic carbon stock and/or accumulation rate) associated with a management activity are the dominant pool, while for forested coastal wetlands, above- and belowground biomass should also be assessed.

For each management activity included in the guidance, a **default emission factor**, known as a **Tier 1 value**, is provided. An emission factor quantifies emissions or removals per unit area for a specific management activity. The Tier 1 default value can be employed when a country does not have sufficient relevant data to estimate nationally representative emissions or removals

associated with a management activity. It is based on available data to provide a globally averaged figure. However, when emissions or removals are significant, it is considered best practice to use an emission factor that is derived from country-level data and is better able to represent national settings and is categorised as a **Tier 2 value**. **Tier 3 approaches** may also be employed, allowing countries to account for all key factors influencing carbon stocks and GHG fluxes, and usually employ the use of empirical models (see Figure 2). Using Tier 2 or Tier 3 methods generally reduces uncertainty in the estimates of emissions and removals.

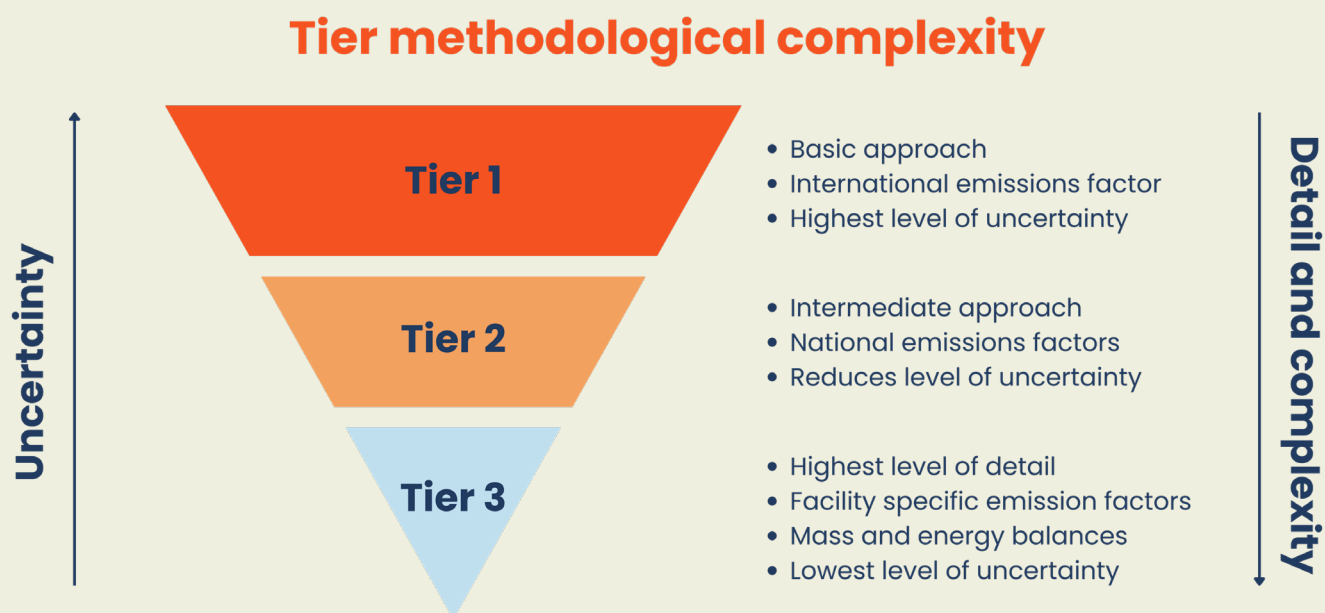


Figure 2: Use of the 2013 IPCC Wetlands Supplement in Reporting National Greenhouse Gas Inventories to the UNFCCC (image adapted from Booyesen et al. 2018²³)

3.2.3 Approaches for considering Land Use Change associated with management activities

In national GHGs, coastal wetlands are covered as a land-use category under the Agriculture, Forestry, and Other Land Use (AFOLU) reporting category. The extent of current land use and any changes due to management actions must be reported. Annual net changes in emissions must be compiled from 1990 through the current inventory year. Any methodological improvements applied must be implemented consistently across the entire time series to ensure comparability. Land-Use change associated with management activities in coastal wetlands, include:

- Forest management practices in mangrove forests
- Soil extraction, in mangrove forests, seagrass meadows, and salt marshes
- Rewetting, revegetation (sometimes termed restoration), and creation of coastal wetlands
- Drainage, in mangrove forests and salt marshes
- Coastal aquaculture

Coastal wetlands are classified into different land-use categories:

- Coastal wetlands remaining coastal wetlands, where management actions maintain these ecosystems.
- Conversion of coastal wetlands to other land uses. Examples are conversion to cropland through drainage, grazing areas, or productive woodlands or extraction to convert to salt ponds or shrimp ponds.
- Conversion of other land uses back to coastal wetlands by rewetting (mangrove forests and salt marshes), or by revegetation or creation (all three coastal wetlands).

To estimate the net change in GHG emissions and removals from coastal wetlands caused by human actions, the emission factor for the associated management action is multiplied by the area of managed coastal wetlands (referred to as 'activity data'). Emissions and removals associated with any management actions are assessed in relation to land-use change.

3.2.4 Options for estimating greenhouse gas fluxes associated with land-use change

Depending on data availability, when including the land use changes in the above mentioned GHGI, countries can adopt either of two approaches to calculate the emissions and removals associated with coastal wetlands:

- The managed land proxy approach which requires countries to fully represent their land area, categorising all their land into one of six broad categories of land (forest land, cropland, grassland, wetlands, settlements, other land). Land area is further subdivided into managed and unmanaged areas of land, with a focus on reporting emissions and removals only from the managed portions. This approach is the most advanced as it requires detailed information on the management covering the whole country.
- The activity-based approach can be used, if there is not enough data to support the managed land proxy. This "bottom-up" method uses activity data, like the area of mangrove forest planted, drained salt marsh or seagrass meadow revegetated, reflecting the specific drivers of emissions. This approach only requires knowledge of the areas where a specific management activity is occurring and is appropriate when data availability is limited.

3.2.5 Further considerations and emerging Blue Carbon Ecosystems

An important consideration for coastal wetlands is that most current definitions of land in national GHGIs are limited to areas inland of the mean high water (MHW) level. To include coastal wetlands that lie seaward of MHW, a country may need to either extend its current national boundary, which would require a reassessment of its managed land proxy, or, more practically, treat any managed coastal wetland outside the existing boundary using the activity-based approach.

Some countries have identified **management activities not currently covered by the 2013 IPCC Wetlands Supplement**, but that still contribute significantly to national GHG emissions and removals. For instance, in the United States of America, subsidence in coastal zones caused by management activities (drainage and reduction of supply of terrestrially sourced soil through impoundments) has led to the loss of coastal wetlands and erosion of their soils. Consequently, emissions associated with the conversion of coastal wetland to open water are included as a distinct land use change category in the national inventory.

Besides the coastal wetlands considered in 2013 IPCC Wetlands Supplement there is a range of **emerging blue carbon ecosystems, such as macroalgae and tidal flats**, that might in the future be considered for their inclusion into official frameworks. These emerging ecosystems are not included in the classical definition of blue carbon ecosystems, due to the criteria historically used to define blue carbon, which focus on coastal plants that store carbon in sediments over long timescales. Moreover, the carbon sequestration potential, carbon vulnerability and permanence of these emerging ecosystems also remains less understood. A few individual countries can already report these ecosystems in their GHGI. Japan, for example, accounts for macroalgae using a Tier 3 approach. This not only demonstrates the political will, but also the feasibility for countries to take such initiatives.





Key summary points for blue carbon ecosystem reporting in EU and international climate policy: ~

- Chapter 4 of the IPCC Wetlands Supplement provides methods for including blue carbon ecosystems (termed 'coastal wetlands': mangroves, tidal marshes (salt marshes), seagrass meadows) in national GHGs.
- Emission estimates are based on emission factors applied to areas of managed wetlands, tracking changes in key carbon pools (especially soil carbon).
- Land-Use Reporting requires consistent reporting of land-use change (wetlands converted, restored, or remaining) annually from 1990 onwards.
- Activities that can be reported for land use change include the following management practices: soil extraction, rewetting, revegetation, and creation of wetlands, as well as drainage in mangroves and tidal wetlands and coastal aquaculture.
- Emission factors for Tier 1 (global defaults) for each management activity are included in the guidance. If there is sufficient data countries can choose to use a Tier 2 (using country specific data) or Tier 3 (modelling related to specific country management action).

Recommendations for blue carbon ecosystem reporting in EU and international climate policy: ~

- Use higher-Tier Methods (Tier 2 or Tier 3) to improve accuracy and reduce uncertainty. Countries can start applying Tier 1 emission factors and improve the tier method over time.
- Increase consistency of reporting annual GHG emissions/removals from 1990 onward, ensuring that methodological changes are consistently applied across the full time series.
- Develop national data capacity, by investing in data collection and monitoring systems to create country-specific emission factors and improve inventory quality.
- If needed, adjust national strategies to select the most suitable approach, choosing between the activity-based approach (for limited data) or the managed land proxy approach (for comprehensive coverage with strong data support).
- Add nationally significant categories, when they meaningfully affect national GHG balances, and the evidence base to support it is sufficient.

3.3 European case studies towards voluntary inclusion of blue carbon into Greenhouse Gas Inventories

“European countries are adopting diverse approaches to the inclusion of blue carbon ecosystems (‘coastal wetlands’) in their GHGIs, reflecting differences in habitat extent and national circumstances. For example, Malta has already included coastal wetland in its inventory, whereas Greece and the United Kingdom have not yet done so but are progressing along different pathways toward inclusion.”



Malta is among the few countries that already reports coastal wetlands in their GHGI, classifying tidal marshes under the category in line with the 2013 IPCC Wetlands Supplement. It uses the Ramsar Convention definition of wetlands, and Malta's two Ramsar wetlands (L-Ghadira and is-Simar) include salt marshes, shrubs, trees, and dunes²⁴. Although the contribution of these sites to removals is small, they are reported as carbon sinks with a combined annual net removal of 0.04 kt CO₂. For areas of coastal wetlands remaining wetlands, as well as land converted to wetlands, the 2013 IPCC Wetlands Supplement methodology and values for the management category 'rewetting, revegetation and creation' are applied for emissions and removals since 1990 across the different carbon pools:

- For biomass, Malta applies emission factors from the 2006 IPCC Guidelines for shrub and grass vegetation, supplemented by regional data from the LIFE Medinet project, as the Wetlands Supplement provides no Tier 1 default values for tidal marsh biomass.
- For soil carbon, the Tier 1 rewetting, revegetation, and creation factors for tidal marsh are applied.
- Methane emissions are reported only for is-Simar between 1990–2009, when salinity was below the threshold; at L-Ghadira, salinity is assumed to prevent methane emissions altogether.

Improvements in spatial mapping are planned through academic collaboration, aiming to enhance and refine land-use coverage and maps for Malta.

Although Malta's National Energy and Climate Plan (NECP) identifies afforestation as an important leverage, it does not explicitly address coastal wetlands²⁵. It acknowledges the limited potential of the LULUCF sector to reverse its net source status.





Greece

Greece hosts significant blue carbon habitats, including seagrass meadows²⁶ and salt marshes²⁷ that could contribute to national climate targets, but none are included in the national inventory under the LULUCF sector. The country holds nearly 10% of all seagrass (*Posidonia oceanica*) meadows in the Mediterranean²⁸, which fulfils the requirements of the EU LULUCF Regulation as protected land units with high carbon storage capacity but under climate threat. In its updated National Energy and Climate Plan (NECP 2021–2030)²⁹, submitted in January 2025, Greece evaluated the effect of implementing additional climate measures beyond existing policies, including carbon sequestration from seagrass³⁰. These estimates show that 763 km² in the South Aegean Sea alone, which represents approximately only one third of the total seagrass extent in the country, sequester around 18,000 tonnes of organic carbon per year.

These measures are expected to increase annual CO₂ removals by 0.1 to 0.2 Mt CO₂ eq. This represents a significant step in recognising the climate mitigation potential of seagrass ecosystems and enhancing the LULUCF sector's role in achieving climate neutrality in the country. However, their inclusion in the national GHGI depends on the availability of robust datasets and internationally recognised methodologies. A dedicated roadmap is needed to guide this process and ensure alignment with global best practices.

Greece has also acknowledged the potential to include carbon removals from seagrass protection and/or restoration into its emerging carbon market³¹, due to start in 2025. This depends on the establishment of standardised and scientifically robust methods for measuring carbon sequestration, to ensure potential credits reflect genuine and verifiable carbon removals.



United Kingdom

The United Kingdom (UK) has taken concrete steps and produced a road map for the inclusion of salt marsh in its GHGI.

In response to the 2013 IPCC Wetlands Supplement, the UK government commissioned a review of available national data on coastal wetland management activities to assess readiness for inclusion³². The findings informed the UK's 'Net Zero Strategy: Build Back Greener'³³ and the subsequent development of the UK Saltmarsh Carbon Code³⁴. A large proportion of saltmarshes in UK is currently reported under the grassland category. In 2023, a report was commissioned by the government to provide a national definition of saltmarshes and a road map for their inclusion in the UK GHGI (Figure 3), including maps where they would replace the current grassland category and assessments of the implications of this change.

A literature review of GHG flux and C stock data applicable to and collected from UK salt marsh habitats has been undertaken³⁵ and a Database and R Shiny app have been created to collate and visualise this data (including maps, plots). In addition, a statistical analysis of the data led to Tier 2 values being derived for UK salt marsh for CO₂ and CH₄.

Current estimates suggest that the 451.65 km² of salt marsh in Great Britain sequester approximately 46,563 ± 4353 tonnes of organic carbon annually. While these removals are relatively modest, this underlines the importance of the large stores of carbon already stored³⁶. To further strengthen the evidence base, the government has established the UK Blue Carbon Evidence Partnership (UKBCEP) to coordinate research across UK administrations. The UKBCEP uses the term blue carbon rather than coastal wetlands, recognising that management activities in other habitats, such as macroalgae (both cultivated and wild), tidal flats, and marine sediments, could increase their carbon sink capacity, though these habitats are currently considered emerging habitats with insufficient evidence of additional climate mitigation benefits³⁷. On the other hand, mangrove forests, seagrass meadows, and salt marshes are viewed as actionable blue carbon habitats with robust scientific backing of their carbon sequestration and storage capacities when protected or restored, as well as growing policy recognition.

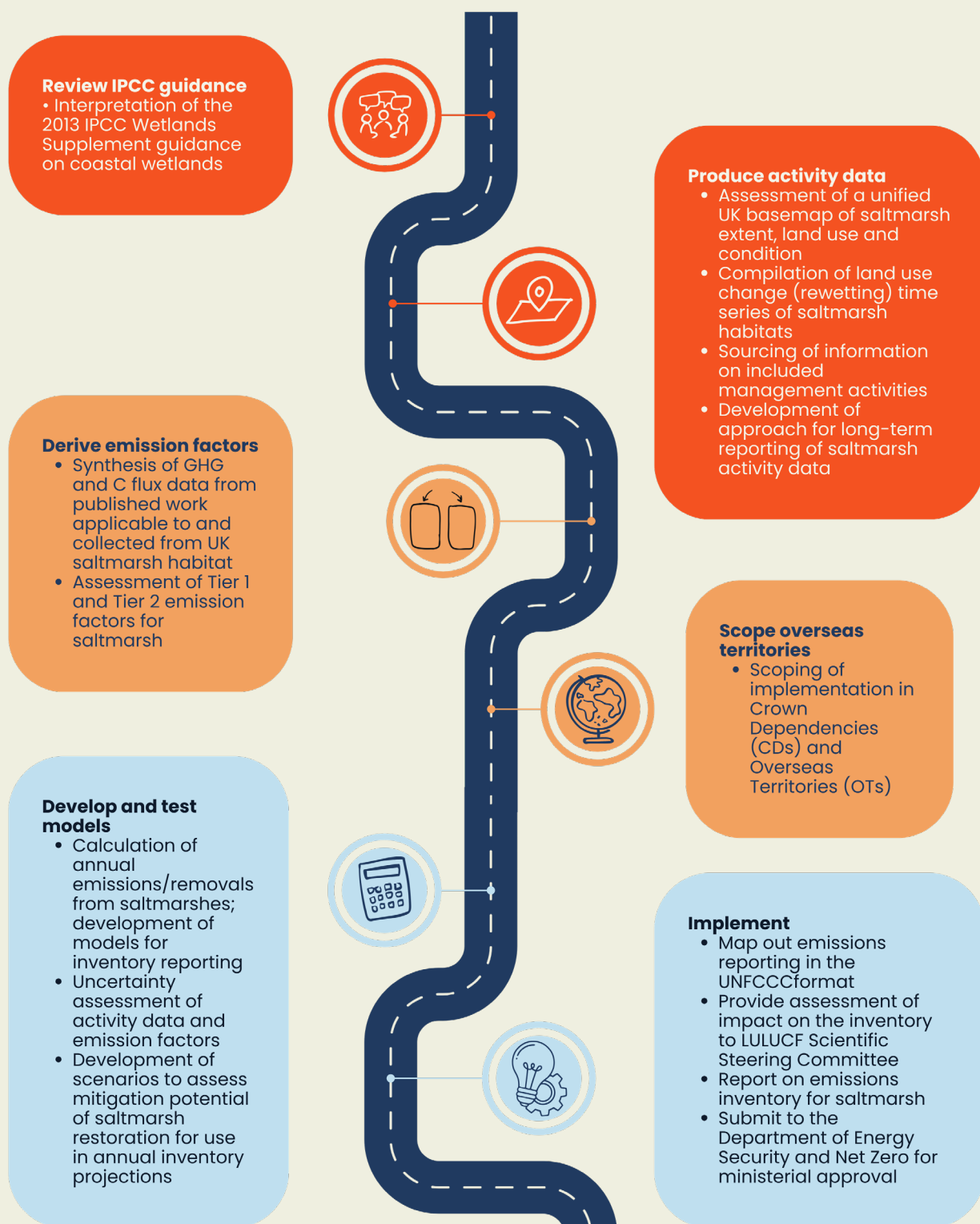
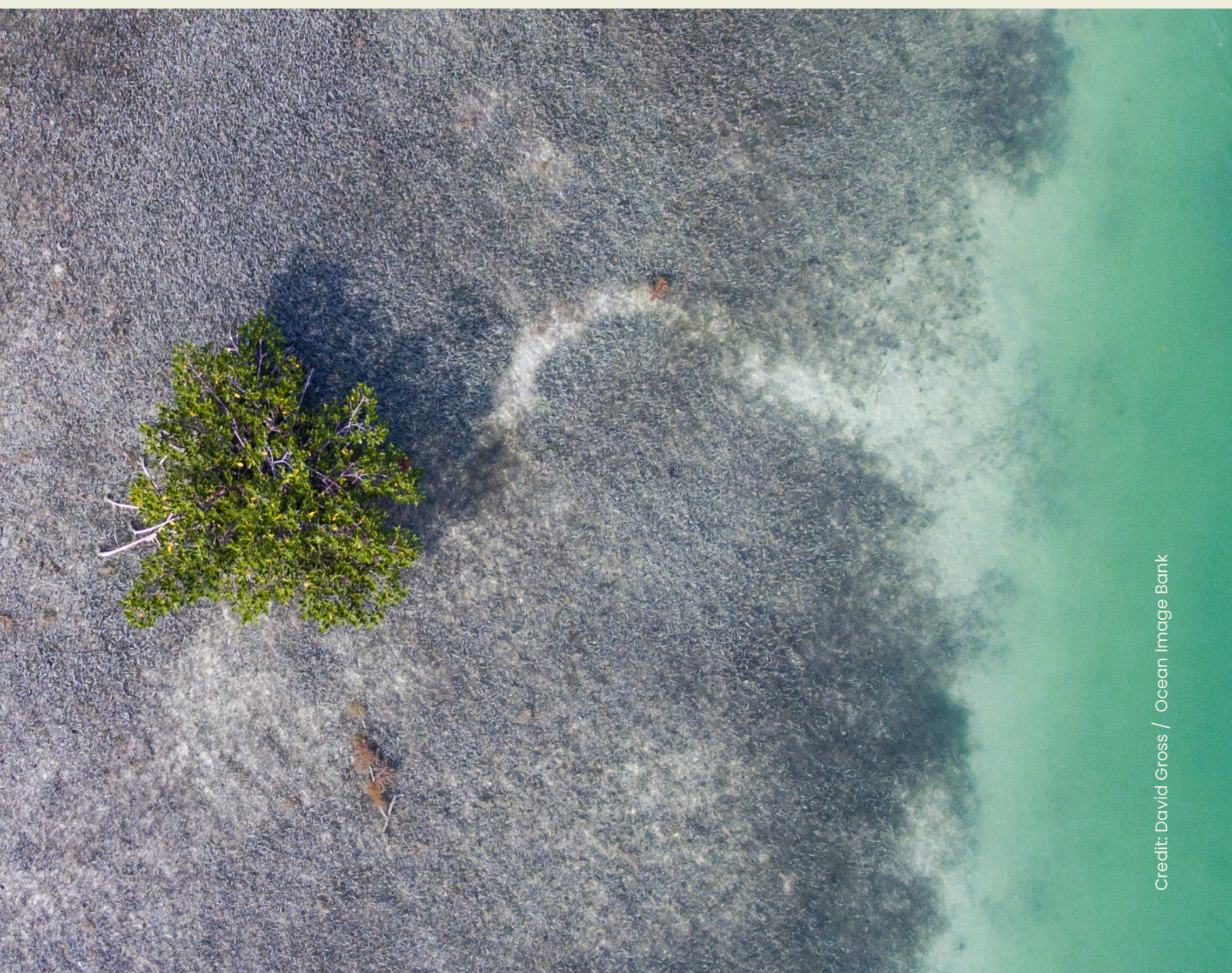


Figure 3: Roadmap detailing the key steps for potential inclusion of saltmarsh in the UK GHG Inventory. Reproduced from Burden et al., 2024.

Key summary points drawing from national experiences to include blue carbon into national GHGIs:

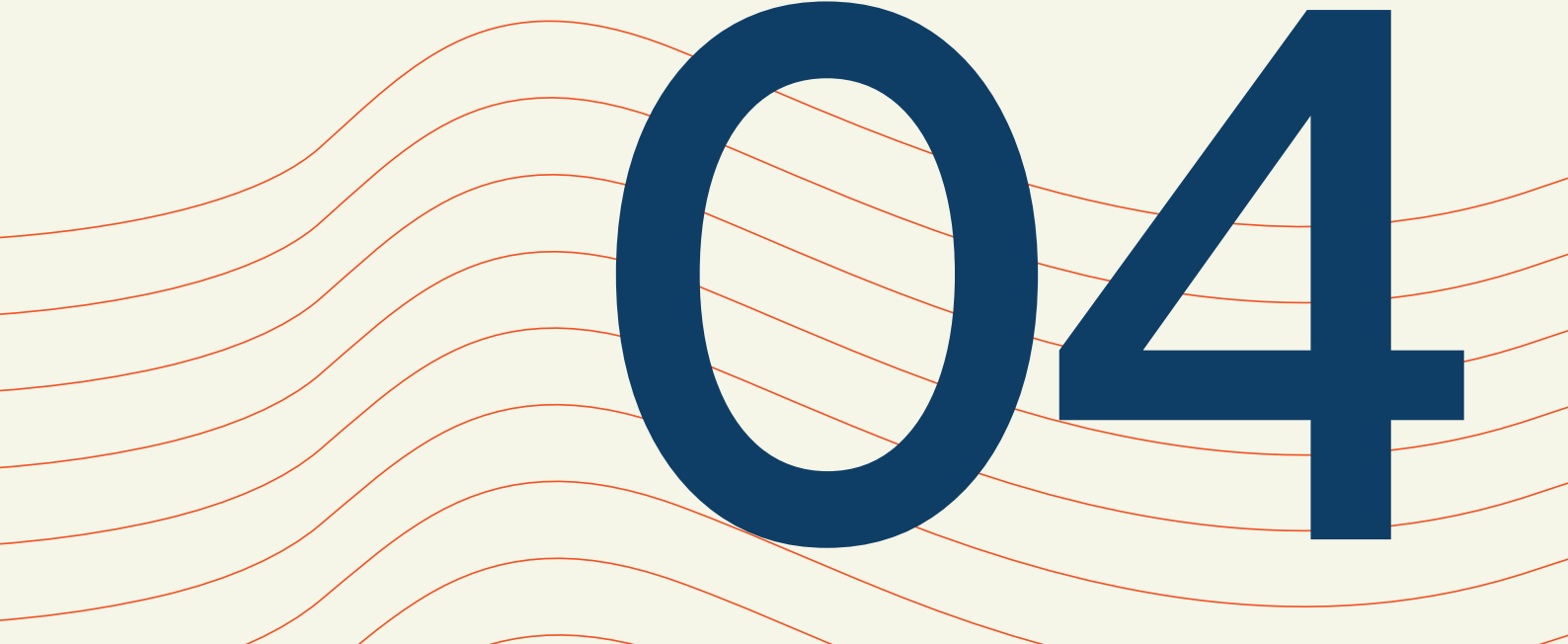
- Malta is the only European country currently reporting blue carbon (tidal marsh) as 'coastal wetlands' under its GHGI. Malta has employed a combination of Tier 1 values from the 2013 IPCC Wetlands Supplement and the 2006 IPCC Guidelines. The reporting uncertainty is high; however, the reported areas are small.
- Greece and the UK assess the potential to include seagrass and tidal marshes.
- Greece's National Climate and Energy Plan considers the inclusion of seagrass as potential carbon sink. Current barriers for inclusion are the lack of region-specific tiers and data on the areal extent, including historical datasets.
- The UK has produced a roadmap outlining necessary steps towards the inclusion of saltmarshes (tidal marsh) into GHGIs.



Credit: Hugh Whyte / Ocean Image Bank



Policy recommendations in a national and European context

The bottom half of the page features several thin, wavy, light orange lines that sweep across the width of the page, creating a sense of movement and depth.

04

4. Policy recommendations in a national and European context

“ The current EU LULUCF Regulation acknowledges that including marine and coastal habitats depends on the further development of robust, science-based reporting methodologies and the availability of reliable scientific data. The following recommendations aim to identify key knowledge gaps that should be addressed to improve reporting approaches, and to explore how existing scientific insights can be more effectively aligned with the policy needs of the EU LULUCF Regulation. ”

4.1 Build capacity and integrate blue carbon knowledge and data

Research into blue carbon ecosystems has a long tradition, pre-dating the conception of the term ‘blue carbon’ itself, and has generated substantial knowledge and data, many of which are not yet fully reflected in national and EU policies. This includes, for example, a lack of nationally available data and consistent, long-term maps of land-use change in the coastal zone, especially from the pre-1990 period.

In recent years, habitat data together with ancillary environmental data have been increasingly aggregated at EU and global levels with policy use in mind. For example, a web tool developed under the Habitats Directive (92/43/EEC) – Article 17 provides access to EU biogeographical and Member States’ assessments of conservation status of the habitats. Further, supporting efforts to include blue carbon (coastal wetlands) in GHGIs, the EU-funded project MPA Europe³⁸ coordinated a pan-European initiative to compile a EUROCARBON database³⁹ to provide organic carbon content estimates of seagrass and tidal marsh.

While databases like this one can provide valuable information, they are commonly scattered across different repositories, and data is often stored in varying formats, levels of detail and commonality of data, making relevant data extraction, consolidation and synthesis time-consuming.

Most knowledge and data driven efforts focus on established blue carbon ecosystems. On the other hand, emerging ecosystems like macroalgae and tidal flats are less represented. While they are increasingly seen as blue carbon ecosystems, for traditional reasons and due to high uncertainty regarding their carbon sequestration potential, carbon vulnerability and carbon permanence, these emerging ecosystems are not considered as ‘coastal wetlands’ by the IPCC.

Recommendation 1: Establish an EU-level centralised hub to strengthen the translation of blue carbon expertise and data into policy

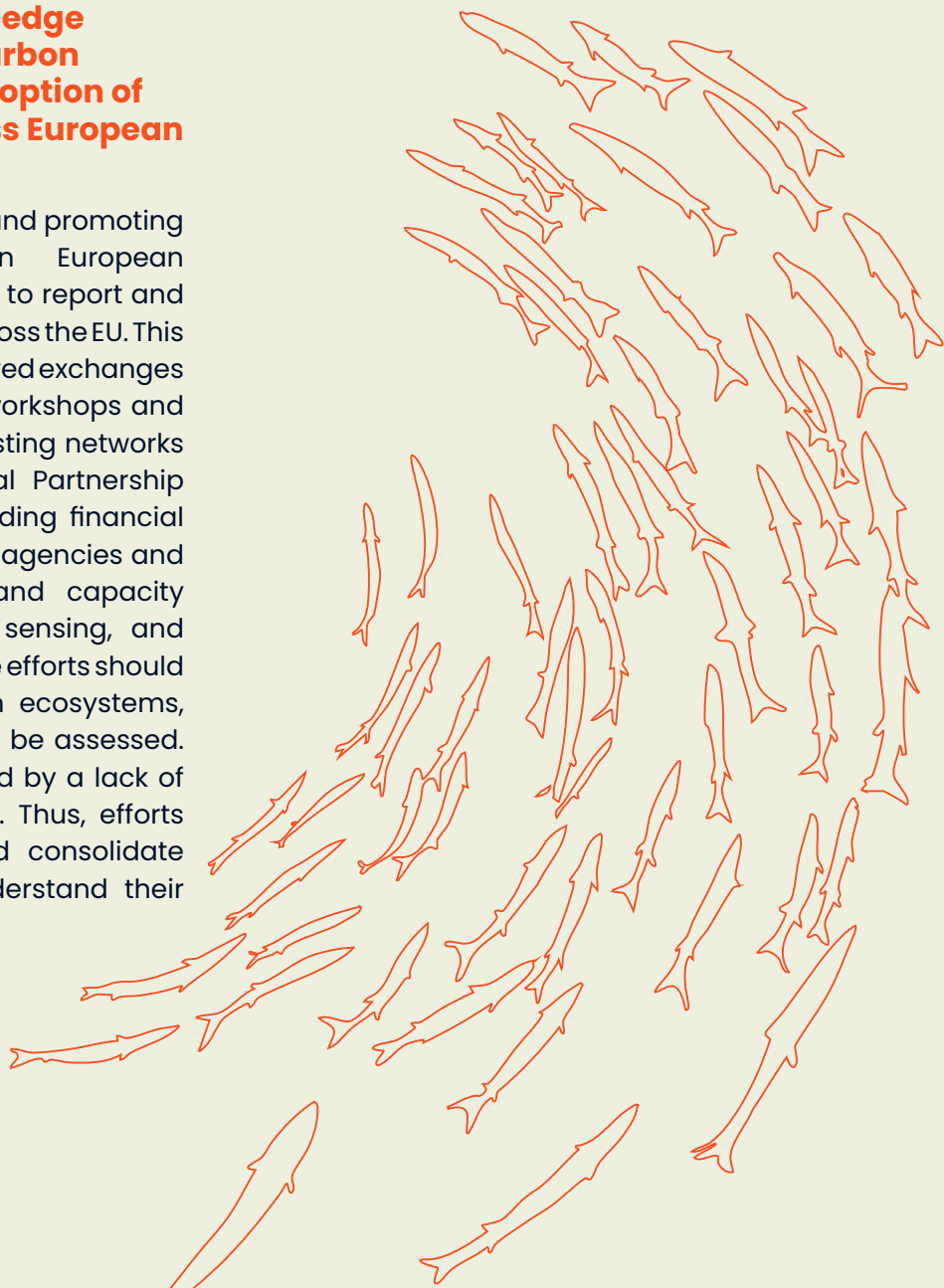
“The establishment of a permanent EU-level mechanism, such as a centralised knowledge and data hub, is recommended to ensure that the existing and growing body of research on blue carbon is better translated into policy-relevant insights. Similar to the idea of the European Regional Hub for Blue Carbon (Euro-BC)⁴⁰ but build as a lasting structure, such a hub would facilitate sharing and synthesis of findings from EU-funded projects, better integrate historical knowledge, and require as well as foster stronger collaboration between compilers, national authorities, and researchers. The hub should encourage contributions on individual country level rather than data aggregated across several countries. This is needed to enable countries to

report on blue carbon ('coastal wetlands') as part of their GHGs. Data collected in such a knowledge and data hub could support the potential future inclusion of coastal wetlands under the EU LULUCF Regulation.

All data collection and reporting should follow FAIR principles (findable, accessible, interoperable, and reusable), and all tiers should comply with the IPCC's TACCC principles (transparency, accuracy, completeness, consistency, and comparability). Moreover, European countries should clearly document classification criteria and methodological choices.

Recommendation 2: Expand technical capacity building and knowledge exchange to support blue carbon integration and potential adoption of emerging ecosystems across European countries

Strengthening technical capacity and promoting knowledge exchange between European countries will enhance capabilities to report and synthesise data and knowledge across the EU. This could be facilitated through structured exchanges between European countries via workshops and technical networks. Leveraging existing networks like for example, the International Partnership for Blue Carbon (IPBC), and providing financial and technical support for national agencies and research institutions would expand capacity in ecosystem mapping, remote sensing, and emission factor development. While efforts should focus on recognised blue carbon ecosystems, emerging ecosystems should also be assessed. Their integration is in part hindered by a lack of aggregated knowledge and data. Thus, efforts should be made to expand and consolidate existing knowledge to better understand their role as a blue carbon ecosystem.



4.2 Align research and innovation with policy needs

Since the concept of blue carbon is relatively new, much of the early work on vegetated coastal wetlands was not designed with policy applications in mind, leading to limited dissemination of actionable data in formats usable by national inventory compilers. As a result, key insights from research do not necessarily translate into improved management of blue carbon ecosystems or more accurate reporting of blue carbon ('coastal wetlands') in GHGI. In addition, the inclusion of coastal wetlands in the IPCC GHGI methodologies was a radical extension of policy from land into the marine realm. Given that there is still room for improvement in terrestrial GHG reporting, some countries may prefer to focus on refining their land-based inventories before expanding their efforts to include coastal wetlands. There may also be some reluctance to extend current boundaries to include coastal wetlands if using the managed land proxy approach.

Despite ambitions to better integrate research objectives with policy demands, there remains a disconnect between the growing body of scientific research, which often aligns more with academic priorities than the practical needs of national inventory compilers or decision makers. This disconnect not only hinders the integration of data research results but also drives the use of inconsistent methods and parameters across European countries, undermining reliable carbon stock estimates.

Recommendation 3: Embed policy objectives and stakeholder consultations into the design and planning of research projects

To increase the policy impact of research, policy objectives should be systematically embedded in research project design from the outset, ensuring that outcomes can be effectively translated into policy discussions and outputs. To support the future inclusion of blue carbon under the EU LULUCF Regulation and to incentivise countries to report on blue carbon using the existing 2013 IPCC Wetlands Supplement, research should consider the reporting requirements and data standards of these policy frameworks. Additionally, research frameworks should incorporate structured consultation processes, as

stakeholder engagement is critical for validating findings and aligning research with practical and societal needs. In light of research to support the uptake of blue carbon in inventory reporting, it is recommended that national authorities and inventory compilers be consulted during the project.

4.3 Enhance the availability of activity data through standardised monitoring and reporting

An important reason for the currently limited inclusion of blue carbon ('coastal wetlands') in GHGIs is the absence of detailed spatial data ('activity data') on these ecosystems and the land-use changes affecting them. Data collection on the spatial extent of blue carbon ecosystems has significantly benefited from progress in improved methods and mapping technology, which for example is the case for salt marshes where a more accurate global map at 10 metre resolution is now available⁴¹. However, limited guidance and an uneven uptake of remote sensing and modelling, hinders accurate and comparable monitoring and can limit the ability to distinguish between different types of blue carbon ecosystems, in particular in restoration cases⁴². Information on where to access publicly available maps of blue carbon ecosystems is needed, alongside a consistent definition of 'coastal wetlands' at the national level to have a compatible approach to mapping. Consistency is also required in the approach to mapping back to 1990 as technology has improved over time, and apparent changes in areal extent can occur due to changes in spatial resolution of the mapping rather than due to management activities.

Despite advances in remote sensing, mapping can be costly and technically challenging. For example, seagrass can inhabit deep or turbid waters, limiting the ability of remote sensing imagery to map their presence and extent. This challenge is compounded by the fact that these habitats can shift rapidly in their distribution.

Recommendation 4: Apply standardised approaches to inventory compilation, including clear definitions of national boundaries and ecosystem extent

Use of the 2013 IPCC Wetlands Supplement methodological guidance, consistent ecosystem classifications, and innovative technology to monitor land-use change, along with the increase in public funding, will strengthen capacity across the EU. This will improve comparability and accessibility of data across existing frameworks and will support more effective implementation of targeted measures to achieve or maintain good environmental status, linking directly to the capacity of ecosystems to sequester and store carbon.

An effort should be made to work towards harmonising definitions of wetlands and consistent reporting. This will help prevent the use of diverse classifications under different categories and will enhance clarity, consistency, and comparability of reporting across European countries.

4.4 Increase the evidence base and application of emission factors

An important reason for the currently limited inclusion of blue carbon ('coastal wetlands') in GHGIs is that many countries are reluctant to rely on Tier 1 values from the 2013 IPCC Wetlands Supplement, as these are global averages based on limited data. Consequently, Tier 1-based reporting is associated with high levels of uncertainty. However, these ecosystems often present small areal extents in EU states, and therefore, the reporting uncertainty caused by Tier 1 values would only make a modest contribution to the accuracy of national GHGIs.

While the EU LULUCF Regulation currently sets no specific tier requirements, this will change from the submission of GHGIs in 2028 onwards, when it will mandate the application of at least Tier 2 methods for all land categories. For some land categories, including wetlands with high carbon stocks, even Tier 3 values will be required. This implies that if blue carbon ecosystems were included under the same EU LULUCF Regulation

in the future, their inclusion would also be dependent on the use of higher-tier methods.

Regarding the potential for countries to be able to move towards higher tiers, more spatially explicit data is generally needed than is currently available at a national scale in European countries. This is especially true for quantifying any changes to the soil pool, where emission factors in the 2013 IPCC Wetlands Supplement are based on carbon stocks and carbon accumulation rates. The use of regionally explicit emission factors may provide a possible step between Tier 1 and country-specific Tier 2 values. Scrutiny of how other countries, such as the USA and Australia, are compiling their inventories can indicate the data requirements and how to approach the task.

Recommendation 5: Improve the accuracy of emission factors through synthesis and further research on blue carbon ecosystem responses to human disturbances

A recent report looked at over 100 projects and found none that quantified impact of human disturbance⁴³. Hence, knowledge synthesis and further research are needed to improve understanding of how blue carbon ecosystems respond to management activities, including differences across ecosystems, latitude, soil type, species present and depth of sediment affected. These insights will reduce uncertainty and improve the accuracy of emission factors for existing and potential additional management activities to be included in any nation's GHGI.

Recommendation 6: Application of Tier 1 values with the ambition to move to higher Tier levels

It is recommended that countries begin applying Tier 1 values as a starting point, while progressively transitioning to higher-tier methodologies over time. This approach would acknowledge that effective management practices will support and strengthen their carbon sequestration potential. In countries where blue carbon ecosystems occupy only small areas, the uncertainty associated with Tier-1 default values has a limited impact on the overall accuracy of the national GHGI. Until the 2028 submission of GHGIs, the use of Tier 1 values is accepted under the EU LULUCF Regulation.

Developing EU-specific tier values, potentially disaggregated on soil type and climate zone, would refine estimates and progressively reduce uncertainty and improve reporting accuracy.

Recommendation 7: Advance towards IPCC Tier 3 methodologies in the EU through harmonised and accessible national datasets

The IPCC encourages countries to use Tier 3 methodologies where feasible. However, the complex cycling of carbon in blue carbon ecosystems makes the development of Tier 3 values challenging to achieve for European countries in the near future. This should nevertheless remain an aim as it will provide spatially integrated fluxes that are more useful for the compilation of inventories. Supporting this goal not only requires policy support that increases harmonisation and accessibility of national datasets (required for Tier 2 and Tier 3 reporting), including remote sensing tools, field surveys, and carbon assessments, monitoring protocols, and ecological condition indicators, but also investments in capacity-building, technical training, and funding support from the EU.

4.5 Develop EU-wide and national Blue Carbon strategies

There is no formal blue carbon strategy at the EU level, and no Member State has developed a dedicated strategy to determine their data availability, recognise knowledge gaps and construct a roadmap for inclusion of blue carbon ecosystems in national GHGI. Although blue carbon ecosystems are increasingly recognised across various policy frameworks and some countries such as Ireland have assessed critical knowledge gaps and future research priorities⁴⁴, cross-cutting strategies are needed to fully unlock their climate mitigation potential and highlight co-benefits such as biodiversity effects and climate adaptation.

Currently, relevant blue carbon policies are embedded within broader ecosystem protection and monitoring frameworks that do not focus on the role of blue carbon specifically. For instance, the assessment of habitat status of seagrass is

currently included under the Water Framework Directive (2000/60/EC)⁴⁵, the Marine Strategy Framework Directive (2008/56/EC)⁴⁶, and the Habitats Directive (92/43/EEC)⁴⁷. However, they use different scales and methodologies, ranging from species-level indicators (i.e., biological quality element) to ecosystem-level priority habitat assessments.

Hence, an assessment is needed to determine whether, and to what extent, elements of these frameworks can contribute to a country's GHGI to inform decision-support tools and actionable policy roadmaps that as of now have remained limited in scope and are still in the early stages of development.

The EU has demonstrated a heightened commitment to coastal and marine protection with the recent adoption of the European Ocean Pact, aiming to bring together EU ocean policies under a unified framework and setting ambitious ocean-related targets. This strategic ambition should further be reinforced through a forthcoming legislative Ocean Act, expected by 2027. While the Ocean Pact is an opportunity that strengthen blue carbon integration into marine policies, the related language remains vague, referring only to a future proposal for the creation of European blue carbon reserves.

Recommendation 8: Develop an EU-wide Blue Carbon Strategy to support the objectives of the Ocean Pact

In light of the recent Oceans Pact and forthcoming Ocean Act, the EU should increase its ambitions in the field of blue carbon through the development of a dedicated blue carbon strategy. A comprehensive strategy would provide a clear and actionable framework for integrating blue carbon into EU climate mitigation and adaptation policies, including the LULUCF Regulation. It would also guide European countries in applying existing 2013 IPCC Wetlands Supplement for reporting, improve consistency in national inventories, and support the scaling of restoration and conservation efforts across coastal and marine ecosystems.

An EU Blue Carbon Strategy should also harmonise various indicators and reporting methodologies across EU legal instruments, as these cause fragmented efforts and administrative burdens.

To create synergies and strengthen the evidence base for reporting under the EU LULUCF Regulation, it should be assessed whether monitoring frameworks and indicators for carbon sequestration can be integrated into existing EU legal frameworks, such as the Marine Strategy Framework Directive. The strategy should also allow flexibility for the future inclusion of new emerging blue carbon ecosystems, such as macroalgae.

Recommendation 9: Adopt dedicated Blue Carbon strategies at a state level

European countries should develop national blue carbon strategies that highlight mitigation and adaptation policies as well as available funding and financing options. The strategies should also include pathways for the future inclusion of blue carbon ecosystems in their national GHGIs. This includes clear definitions of blue carbon ecosystems (potentially with classification of managed versus unmanaged if using the managed land proxy), an overview of existing data repositories, and identification of current knowledge gaps or institutional barriers. While targeted ecosystem-specific plans, such as the UK Saltmarsh Roadmap⁴⁸ for potential inclusion of saltmarsh in the UK GHGI, offer important guidance, they should be embedded within broader, integrated blue carbon strategies. This requires strengthening cross-sectoral and inter-institutional coordination and alignment between environmental, maritime, and climate authorities to integrate biodiversity, climate, and coastal management efforts, together with the appreciation of the climate change mitigation value of blue carbon ecosystems. This could be strengthened by the development of national evidence needs reports and the development of a roadmap to inclusion in GHGI.

4.6 Mobilising public funding and private financing for blue carbon

The Sustainable Development Goal (SDG) 14, Life below water, is the least funded among all SDGs⁴⁹. Despite a recent increase in global attention, coastal vegetated habitats remain severely underfunded. Government budgets for marine conservation are often limited and are not even close to the rates required⁵⁰ with far greater priority and financing directed toward forest under SGD 15 (Life on Land). Furthermore, public funding varies widely between European countries and fluctuates with election cycles. As a result, knowledge on the extent, damage or loss, and land-use changes is often generated through highly competitive short-term research grants with a limited policy focus, making long-term assessments hard to sustain, hence hindering their integration into GHGI. The European Ocean Pact allocates one billion euros for ocean protection and the blue economy⁵¹, but funding details and obligations for blue carbon remain undefined.

Carbon markets are a key funding mechanism for financial blue carbon projects to conserve, restore and sustainably manage blue carbon ecosystems. Although issuance has grown significantly, particularly from large-scale projects in developing countries, carbon credits largely focus on mangrove forests and have not yet been issued for projects located in Europe⁵². This reflects Europe's lack of mangroves (except small overseas territories), which dominate global blue carbon markets with mature methodologies. For temperate seagrass and salt marshes, technical barriers remain: variable carbon accumulation rates, additionality challenges, and permanence risks. France's Label Bas Carbone recently issued first seagrass credits for *P. Oceanica* (Posbacia25), a promising but pilot-scale development requiring broader validation. Instead, European blue carbon efforts rely on short-term public funding, insufficient for the long-term monitoring (10+ years) needed under LULUCF.

Public funding typically operates on multi-year cycles and must establish enabling conditions, including Measurement, Reporting, and Verification (MRV) infrastructure, institutional capacity, and regulatory frameworks, before market-based mechanisms become viable (typically 5–10 years)⁵³.

Moreover, quantifying and verifying carbon removals is essential for both for public funding and private financing. Developing robust MRV systems requires sustained investment in scientific research to refine carbon flux measurements for temperate ecosystems, monitoring infrastructure (remote sensing, field sampling), and technical capacity building. These foundational investments, typically funded through national research budgets, EU programmes (Horizon Europe, LIFE), and academic partnerships, precede and enable subsequent market-based finance.

Private investors might perceive high risks due to uncertainties in sequestration rates, potential reversals, verification challenges, fragmented coastal governance, and the cost and scale of restoration needed to provide a financially viable project⁵⁴. Aligning methodologies across regulatory and voluntary credit systems such as LULUCF or the EU Carbon Removal Certification Framework (CRCF) would provide greater price stability and attract private investment.

In addition, relying solely on carbon as the financial driver might undervalue the broader co-benefits like biodiversity, coastal protection, and livelihoods, reducing the potential for resilient funding models. The European Commission has recently started an initiative to develop a roadmap towards nature credits⁵⁵, covering broader than just carbon credits. While this is a positive outcome and feedback to the roadmap included considerable input on marine systems, the focus is largely on terrestrial ecosystems and less on blue carbon ecosystems, suggesting that their importance for climate regulation in the policy realm should be strengthened. Blue carbon ecosystems are currently considered in future phases, notably seagrass meadows, but this remains exploratory and dependent on resolving methodological challenges around permanence, additionality, and attribution in marine systems.



Recommendation 10: Align blue carbon methodologies with compliance and certification systems to unlock investment

Blue carbon projects should be integrated into EU compliance frameworks such as the LULUCF and the CRCF, through the development of robust, science-based methodologies for blue carbon accounting with clear alignment between the two. Doing so would provide the regulatory certainty and long-term price signals needed to attract private capital, while ensuring high integrity through robust monitoring, reporting, and verification standards. Clear rules on how credits interact with national inventories, distinguishing between contribution and offsetting claims, are essential to avoid double-counting and build investor confidence.

Recommendation 11: Promote blended finance approaches to complement LULUCF accounting and leverage private capital

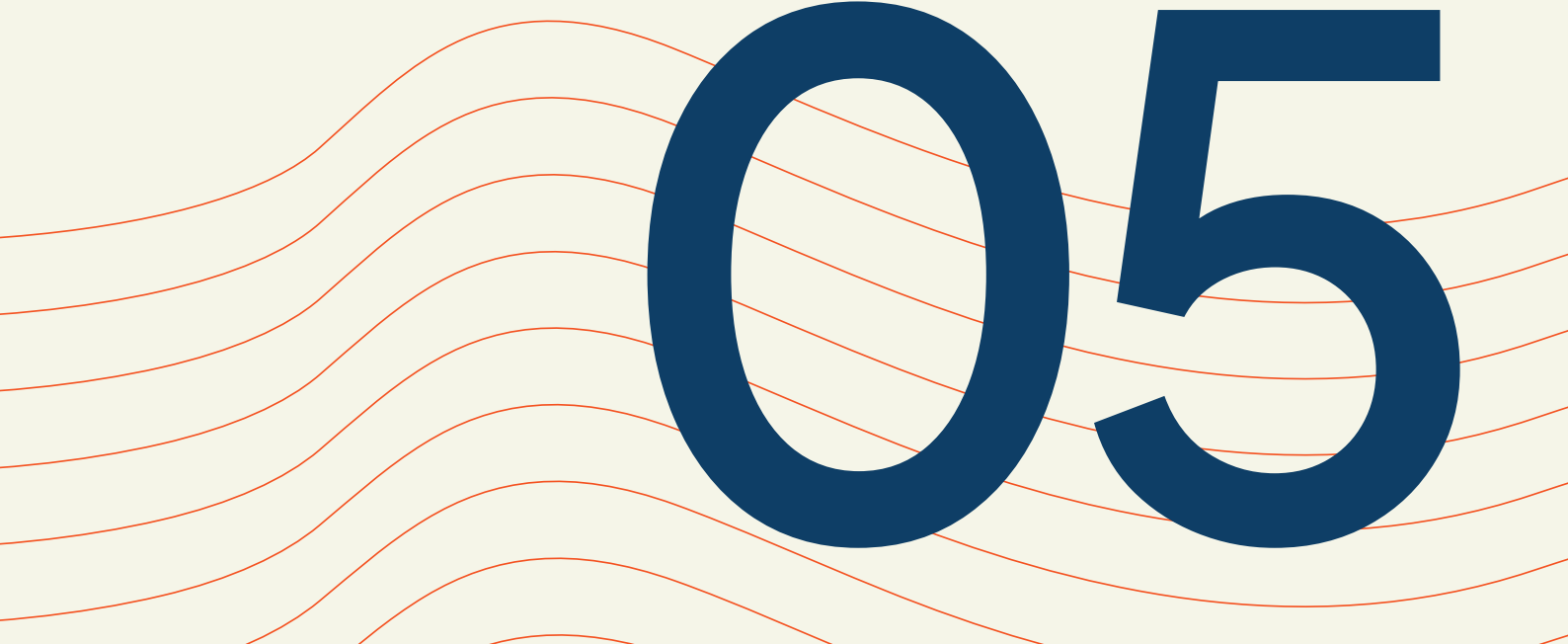
Because compliance with LULUCF requires long-term monitoring and robust verification, public funding should be deployed strategically to de-risk projects by covering high-cost, early-stage components such as feasibility studies and long-term Measurement, Reporting, and Verification (MRV). Leveraging EU and national funds in this way can promote private investment, with investors then financing scalable restoration activities under the security of being recognised in LULUCF inventories and CRCF certification. Blended finance models, potentially linked to the EU's emerging nature credit roadmap, can ensure that blue carbon projects meet compliance standards while also generating co-benefits such as biodiversity conservation and coastal protection.



Credit: Ben Jones / Ocean Image Bank



References

The background of the lower half of the page features several thin, wavy, orange lines that create a sense of movement and depth. These lines are layered behind the large number '05'.

05

5. References

1. IPCC Sixth Assessment Report Annex VII Glossary. Available at: https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_AnnexVII.pdf.
2. Hiraishi, T. et al. (2013). Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands. Available at: <https://www.ipcc.ch/publication/2013-supplement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories-wetlands/>.
3. Sheehy, J., Porter, J., Bell, M., & Kerr, S. (2024).. Redefining blue carbon with adaptive valuation for global policy. *Science of the Total Environment*, 908, 168253.
4. Zimmer, M. et al (2022). When nature needs a helping hand: Different levels of human intervention for mangrove (re-) establishment. *Frontiers in Forests and Global Change*, 5. doi.org/10.3389/ffgc.2022.784322.
5. Herr, D. and Landis, E. (2016). Coastal blue carbon ecosystems. Opportunities for Nationally Determined Contributions. Policy Brief. Gland, Switzerland: IUCN and Washington, DC, USA: TNC.; Kelleway, J.J., Serrano, O., Baldock, J.A., Burgess, R., et al., (2020). A national approach to greenhouse gas abatement through blue carbon management. *Global Environmental Change*, 63, 102083. <https://doi.org/10.1016/j.gloenvcha.2020.102083>.
6. European Commission: Directorate-General for Research and Innovation, Publications Office of the European Union and CORDIS, Blue carbon for biodiversity and climate action – A projects info pack by CORDIS, Publications Office of the European Union, 2024, <https://data.europa.eu/doi/10.2830/19931>.
7. Conference of the parties to the Convention on Biological Diversity, Decision 15/4. Kunming-Montreal Global Biodiversity Framework, CBD/COP/DEC/15/4, 19 December 2022.
8. Fu, C., Steckbauer, A., Mann, H. et al. (2024). Achieving the Kunming-Montreal global biodiversity targets for blue carbon ecosystems. *Nature Reviews Earth & Environment*, 5, 538–552 (2024). <https://doi.org/10.1038/s43017-024-00566-6>.
9. Communication from the Commission, The European Green Deal, COM/2019/640 final, 11 December 2019. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52019DC0640>.
10. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, EU Biodiversity Strategy for 2030: Bringing nature back into our lives. COM/2020/380 final. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52020DC0380>.
11. Regulation of the European Parliament and of the Council on nature restoration. Available at: <https://data.consilium.europa.eu/doc/document/PE-74-2023-INIT/en/pdf>.
12. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, The European Ocean Pact. COM/2025/281 final. Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=comnat:COM_2025_0281_FIN.
13. Policy Framework for Blue Carbon Ecosystems, Accelerating conservation of coastal ecosystems through coherent and aligned international policies. Available at: <https://www.bluecarbonpolicy.org/#:~:text=THE%20FRAMEWORK%20The%20International%20Policy%20Framework%20for%20Blue,and%20restoration%20in%20the%20relevant%20international%20policy%20processes>.

14. Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 (European Climate Law), Official Journal of the European Union, L 243, 9 July 2021, pp. 1–17. Available at: <https://eur-lex.europa.eu/eli/reg/2021/1119/oj/eng>
15. Fit for 55. Available at: <https://www.consilium.europa.eu/en/policies/fit-for-55/>.
16. Regulation (EU) 2023/839 of the European Parliament and of the Council of 19 April 2023 amending Regulation (EU) 2018/841 as regards the scope, simplifying the reporting and compliance rules, and setting out the targets of the Member States for 2030, and Regulation (EU) 2018/1999 as regards improvement in monitoring, reporting, tracking of progress and review (Text with EEA relevance), OJ L 107, 21.4.2023, pp. 1–28. Available at: <https://eur-lex.europa.eu/eli/reg/2023/839/oj/eng>.
17. Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU, Official Journal of the European Union, L 156, 19 June 2018, pp. 1–25. Available at: <https://eur-lex.europa.eu/eli/reg/2018/841/oj/eng>.
18. European Parliament, Briefing EU Legislation in Progress – Revision of the LULUCF Regulation, available at [https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698843/EPRS_BRI\(2021\)698843_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698843/EPRS_BRI(2021)698843_EN.pdf).
19. European Environment Agency (EEA) and European Commission, Handbook on the Updated LULUCF Regulation EU 2018/841 – Guidance and Orientation for the Implementation of the Updated Regulation, Version 2, EEA, Copenhagen. Available at: <https://climate-energy.eea.europa.eu/topics/climate-change-mitigation/land-and-forests/reports/handbook-on-the-update-lulucf-regulation-v2>.
20. Gabriella Locati, “FIT FOR 55 FACTSHEET: Land Use, Land Use Change And Forestry (LULUCF),” ClimaTalk, June 6, 2022, <https://climataalk.org/2022/06/06/land-use-land-use-change-and-forestry/>.
21. Article 17(2), Regulation (EU) 2023/839 of the European Parliament and of the Council amending Regulation (EU) 2018/841.
22. European Commission, Report from the Commission to the European Parliament and the Council on the operation of Regulation (EU) 2018/841 («LULUCF Regulation») pursuant to Article 17(2) as amended by Regulation (EU) 2023/839, COM(2024) 195 final, Brussels, 15 May 2024. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52024DC0195>.
23. Booysen, Janine, Walter Booysen, and Marius Kleingeld. «A risk management strategy to identify and prioritise factors affecting industry’s carbon tax liability.» *South African Journal of Industrial Engineering* 29.3 (2018): 26–39.
24. Climate Action Authority. Malta’s National Inventory Document of Greenhouse Gas Emissions & Removals: 1990–2023. Final version submitted April 2025. Ministry for the Environment, Energy and Public Cleanliness.
25. Government of Malta. Malta’s 2030 National Energy and Climate Plan. December 2019.
26. Panayotidis, P. et al. (2022) Seagrass meadows in the Greek Seas: presence, abundance and spatial distribution, *Botanica Marina*, vol. 65, no. 4, 2022, pp. 289–299. <https://doi.org/10.1515/bot-2022-0011>. Available at: https://www.degruyterbrill.com/document/doi/10.1515/bot-2022-0011/html?srsId=AfmBOOp0ETSxgCIQIA3YS69e9TwYvoBKNPVvz-O-D_UAuy-cku3x7l6m.
27. Tsiaoussi V., E. Fitoka, and M. Tompoulidou (2020) Transitional Ecosystems along the Aegean Sea Coastline of Greece. In: *The Handbook of Environmental Chemistry*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-662-66688-8_668.
28. Pergent-Martini, C., et al. (2021) Contribution of *Posidonia oceanica* meadows in the context of climate change mitigation in the Mediterranean Sea, *Marine Environmental Research*, Volume 165, 105236, ISSN 0141-1136, <https://doi.org/10.1016/j.marenvres.2020.105236>.

-
29. Greece's National Energy and Climate Plan, Athens, 2024. Available at : https://commission.europa.eu/document/download/b2fbbef4-ee32-44fc-acce-49737bf492c8_en?filename=EL%20-%20FINAL%20UPDATED%20NECP%202021-2030%20%28English%29.pdf.
30. Apostolaki et al (2026) The untapped potential of Poseidon grass in Greece as a hotspot for climate change mitigation. *Regional Environmental Change* (2026) 26:21. <https://doi.org/10.1007/s10113-025-02503-9>
31. The Green Tank, Coastal vegetated ecosystems: An ally against climate crisis. Available at: <https://thegreentank.gr/en/2024/04/27/blue-carbon-side-event/>,
32. Burden, A. and Clilverd, H. (2022) Moving towards inclusion of coastal wetlands in the UK LULUCF inventory: rapid assessment of activity data availability. Bangor, UK Centre for Ecology & Hydrology, 61pp. (UKCEH Project no. C05984). Available at : <https://nora.nerc.ac.uk/id/eprint/533055/>.
33. Net Zero Strategy: Build Back Greener, October 2021. Available at: <https://assets.publishing.service.gov.uk/media/6194dfa4d3bf7f0555071b1b/net-zero-strategy-beis.pdf>.
34. UK Centre for Ecology and Hydrology, Saltmarsh code. Available at: <https://www.ceh.ac.uk/our-science/projects/uk-saltmarsh-code>.
35. Clilverd, H., Burden, A., Carter, S., Buys, G., Ferguson, S. (2024) Database of saltmarsh carbon stock and GHG flux data applicable to the UK. Documentation of the systematic literature review. Report to the Environment Agency. UK Centre for Ecology & Hydrology, Edinburgh. 31pp.
36. Smeaton, S., et al. (2024) Organic carbon accumulation in British saltmarshes, *Science of The Total Environment*, Volume 926, 172104, ISSN 0048-9697, <https://doi.org/10.1016/j.scitotenv.2024.172104>.
37. Howard, J., et al. (2023) Blue carbon pathways for climate mitigation: Known, emerging and unlikely, *Marine Policy*, Volume 156, 2023, 105788, ISSN 0308-597X, <https://doi.org/10.1016/j.marpol.2023.105788>.
38. MPA-Europe. Available at: www.mpa-europe.eu.
39. Anna Elizabeth Løvgren Graversen et al., 2025 A marine and salt marsh sediment organic carbon database for European regional seas (EURO-CARBON), Data in Brief, <https://doi.org/10.1016/j.dib.2025.111595>.
40. <https://oceandecade.org/actions/european-regional-hub-for-blue-carbon/>
41. Worthington TA, Spalding M, Landis E, Maxwell TL, Navarro A, Smart LS, Murray NJ. The distribution of global tidal marshes from earth observation data. *Global Ecology and Biogeography*. 2024 Aug;33(8):e13852.
42. Hannah Clilverd, Jennifer Williamson, Rachel Nickerson, Angus Garbutt, Annette Burden, 2025. Monitoring UK saltmarsh restoration using earth observation for national greenhouse gas accounting, *Ecological Indicators*, <https://doi.org/10.1016/j.ecolind.2025.113867>.
43. European Commission: European Climate, Infrastructure and Environment Executive Agency, Trinomics, Ricardo, and Blue Carbon Lab, Studies in support to the implementation of the mission – Wetlands and blue carbon – Final report, Publications Office of the European Union, 2025, <https://data.europa.eu/doi/10.2926/9638373>.
44. Cott, G. M., Beca-Carretero, P. and Stengel, D. B. (2021). Blue Carbon and Marine Carbon Sequestration in Irish Waters and Coastal Habitats. Marine Institute, Ireland. Available at: <https://oar.marine.ie/handle/10793/1685>.
45. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, *Official Journal L 327*. Available at: <https://eur-lex.europa.eu/eli/dir/2000/60/oj/eng>.
46. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy, *Official Journal L 164*. Available at: <https://eur-lex.europa.eu/eli/dir/2008/56/oj/eng>.

47. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, Official Journal L 206. Available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:31992L0043>.
48. See (35) Burden et al., 2024.
49. World Economic Forum, SDG14 Financing Landscape Scan: Tracking Funds to Realize Sustainable Outcomes for the Ocean, White Paper, June 2022. Available at: https://www3.weforum.org/docs/WEF_Tracking_Investment_in_and_Progress_Toward_SDG14.pdf
50. Despina F. Johansen, Rolf A. Vestvik (2020) The cost of saving our ocean – estimating the funding gap of sustainable development goal 14, Marine Policy, Volume 112, 103783, ISSN 0308-597X, <https://doi.org/10.1016/j.marpol.2019.103783>.
51. European Commission, Commission adopts Ocean Pact with €1 billion to protect marine life and strengthen blue economy, 11 June 2025. Available at: https://commission.europa.eu/news-and-media/news/commission-adopts-ocean-pact-eu1-billion-protect-marine-life-and-strengthen-blue-economy-2025-06-11_en.
52. Farahmand et al (2025) The rise and flows of blue carbon credits advance global climate and biodiversity goals. Available at: <https://www.nature.com/articles/s44183-025-00141-6>.
53. UNESCO-IOC Blue Carbon Finance Toolbox, 2025. Available at: <https://unesdoc.unesco.org/ark:/48223/pf0000393916.locale=en>.
54. UNESCO-IOC (2025). Blue carbon finance toolbox. Available at: <https://unesdoc.unesco.org/ark:/48223/pf0000393916.locale=en>.
55. European Commission, Roadmap towards nature credits. Available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14723-Roadmap-towards-Nature-Credits_en



Advancing knowledge,
informing policy,
driving innovation