Project *brief*

Thünen Institute of Sea Fisheries 2026/08a

# Ecosystem-based marine spatial planning bridges conservation objectives with sustainable human use

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- **Planning scenarios make long-term risks and opportunities more visible**
- **Data gaps and fragmented governance at the regional scale limit planning effectiveness**
- **The MarinePlan project provides decision-making tools for the practical implementation of ecosystem-based marine spatial planning**

## Background and objectives

Human activities and their associated pressures on the ocean, combined with the impacts of climate change, are increasing the risk of harmful effects on marine ecosystem components, functions, and processes. To halt further loss, international goals aim to protect 30% of marine areas by 2030, with 10% designated as no-use zones. At the same time, the expansion of green energy requires better coordination between marine spatial planning and systematic conservation planning. As a forward-thinking approach, maritime spatial planning can integrate conservation and usage objectives, while strategically managing human activities,a key step towards ecosystem-based marine spatial planning (EB-MSP). The main goal of the Horizon Europe project MarinePlan was to support the implementation of a stakeholder-informed Decision Support System (DSS) for EB-MSP designed to provide practical guidance on aligning MSP processes with spatial conservation and restoration efforts.

MarinePlan defined four key objectives: 1) developing practical decision-making tools in close collaboration with stakeholders to integrate conservation and restoration goals into spatial planning; 2) creating quantitative metrics to identify ecologically or biologically significant marine areas (EBSA) as a foundation for effective conservation planning; 3) applying and testing these tools in eight representative European planning sites with varying ecological conditions, human pressures, and spatial scales; and 4) formulating practice-oriented recommendations, including identified challenges and opportunities, to enhance the future implementation of EB-MSP across Europe.Each planning site developed at least a realistic scenario and planning solutions for achieving the 2030-30-10 target. Finally, the project aimed to deliver recommendations that highlight challenges, opportunities, and areas for improvement within existing governance processes to strengthen the effective implementation of EB-MSP.

## Approach

Since the co-development of the DSS elements with stakeholders was a key requirement, the first step was to define for each planning site the most influential and interested stakeholders with whom the respective tools and guidance have been developed (D5.1). Incorporating social science approaches, we further developed detailed guidance for policy analysis to understand the actual barriers for EB-MSP and the adaptive capacity of national regional governance processes. The next step was to define an EB-MSP process template, which allowed to assess or evaluate the state of national planning processes (D1.1, D5.1). Further, this process template was verified by a high-level workshop with national planners (Galparsoro et al. 2025) and made available as an easy-to-access online tool. The EBSA criteria were operationalised for each planning sites (D2.1, D2.2), whereby the underlying data and the number of EBSA criteria varied (Lukyanova et al. 2025). MarinePlan's approach moved beyond the state of the art by combining the EBSA criteria with metrics for structural connectivity within the regions for area prioritisation. Next to a realistic planning scenario, we defined hypothetical extreme scenarios in which climate change and economic crises determined the choices of the features to be protected as well as the intensity and spread of human activities (D3.3). To support the scenario analysis, we developed a decision tree (see fig. 1) which guided the planning sites to specify planning narratives and objectives, and how best to combine ecological features with economic costs (trade-offs) using various prioritisation tools (e.g., prioritizr, prior3D, priorCON) to generate robust planning options (D3.2, D5.2).

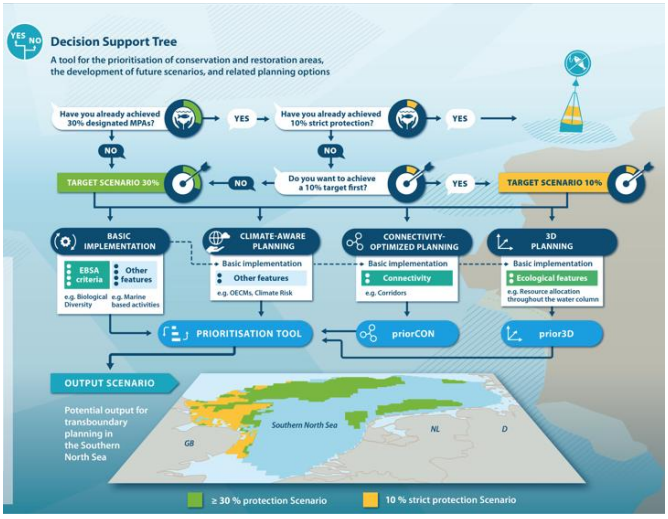


**Figure 1:** Decision tree to guide the scenario building and prioritisation analysis of MPA networks across the MarinePlan planning sites. (Source: MarinePlan Images).

The scenario results and lessons learned were provided to stakeholders and for each planning site tailored recommendations were developed.

## Results

Realistic scenarios across planning sites were developed to meet the EU Biodiversity Strategy 2030 targets of protecting 30% of marine areas, including 10% under strict protection (see fig. 2). All scenarios embraced ecosystem-based management, treating each region as an interconnected ecological system despite fragmented governance, and in transboundary sites, limited cross-border coordination. EBSAs and ecological connectivity were incorporated with shared principles but methods varied to reflect regional priorities and data availability. Most sites applied EBSA criteria using layers for species, habitats, and life-history stages, though scoring approaches differed. Connectivity approaches also differed: Campania, the Western Mediterranean, and the Greek Aegean/Ionian Seas used advanced tools such as PriorCON and Lagrangian dispersal models to estimate structural connectivity of species groups while the Southern North Sea focused on connectivity of oyster; the Bay of Biscay incorporated connectivity implicitly through ecosystem-wide planning; and the Celtic Seas relied on MPA configuration due to limited data. Overall, EBSA layers formed a common basis, but connectivity analysis ranged from sophisticated modeling to pragmatic, data-driven approximations, reflecting diverse regional pathways for achieving ecological coherence in spatial planning.

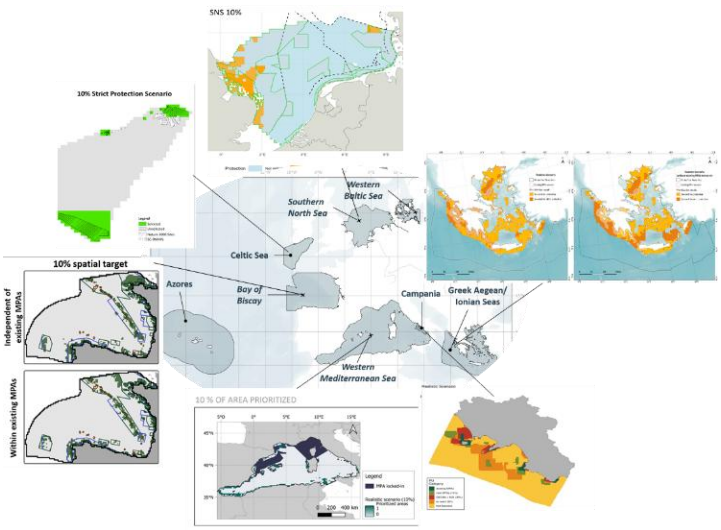


**Figure 2:** Overview of realistic planning scenarios with areas of 10 % strict protection (Source: own representation).

The analysis of barriers and obstacles for the adaptive capacity of prevailing governance approaches revealed limited resourcing and political will, as well as concerns regarding the potential risks of change (D4.2, D4.3). Key barriers that have been identified across the planning sites included difficulties in establishing trade-offs between competing objectives, the development of fragmented governance and data systems, limited cross-border cooperation and collaboration, inadequate consultation and stakeholder engagement, ineffective or outdated policy and management measures, insufficient monitoring mechanisms, and a lack of political will and commitment to support innovation and transformation. A number of practical recommendations were presented as Story Maps and policy briefs for each planning site (D4.3, available at marineplan.eu). Hence, several common solutions are discussed, including the need to enable leadership within governance networks, as well as strategic efforts to bring together people, resources and knowledge. These factors have the potential to serve as catalysts for alternative processes and practices to be implemented.

## Conclusions

The MarinePlan DSS provides practical tools to support ecosystem-based MSP, showing that scenario-driven planning can push thinking beyond the short-term constraints that typically shape marine governance. By anchoring planning options in forward-looking scenario narratives, the planning sites were able to consider long-term ecological, socio-economic, and political changes, revealing risks and opportunities that conventional planning timeframes might overlook. However, the effectiveness of these scenarios was limited by data gaps, restricted connectivity modelling, and fragmented governance, especially across borders. Strengthening EB-MSP implementation in the future will require developing robust future scenarios aligned with EU conservation targets and climate and socio-economic transitions; advancing co-development through participatory processes that help identify data gaps; improving institutional data exchange and interoperability with open data repositories; and addressing the impacts of planning scenarios by filling knowledge gaps needed to assess co-benefits, trade-offs, and synergies within integrated spatial planning.

## Further information

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**DOI:10.3220/253-2026-25**

**Run time**

9.2022-9.2025

**Project-ID**

2493

**Publications**

Galparsoro et al. (2025), Assessment tool addresses implementation challenges of ecosystem-based management principles in marine spatial planning processes. Commun Earth Environ 6, 55.

Lukyanova et al (2025), Operationalising Ecologically or Biologically Significant Marine Areas criteria for ecosystem-based conservation and management: The Bay of Biscay case. Biological Conservation, 308.

**Funding**

European Commission

HORIZON Europe, Grant numbers 10038951 & 10050537