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Università Iuav  
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# Coastal Cities, Climate Resilience and Cultural Heritage Preservation

17 November 2025

Teatro Piccolo Arsenale, Venezia

## The role of spatial planning for coastal adaptation

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Università Iuav di Venezia and Corila



# Spatial Planning for coastal system

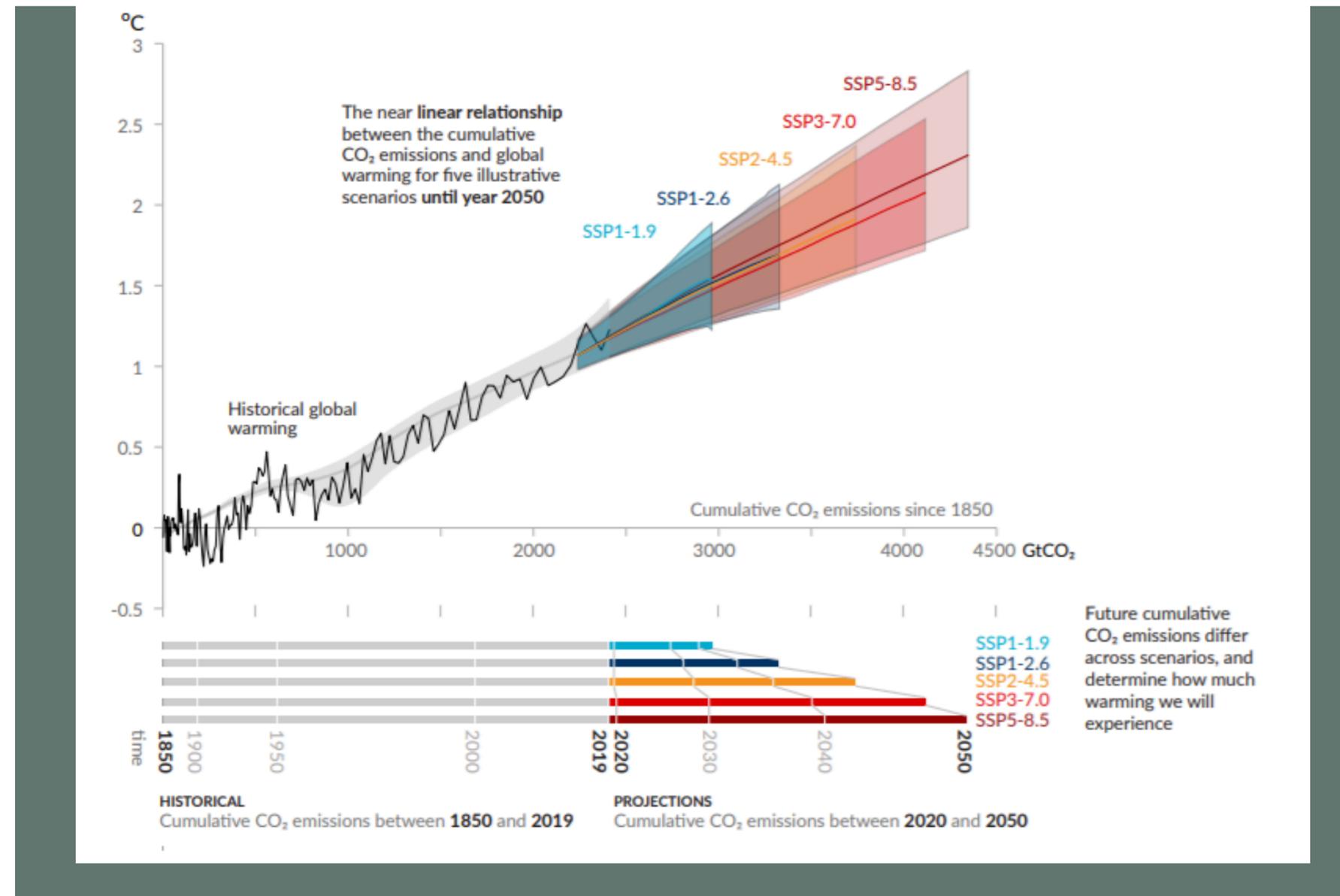
Coastal cities are increasingly at **the frontline of climate risk**, due the global increase of climate externalities.

More than 600 million people currently live less than 10 metres above sea level, and this number could double by the end of the century

**Sea-level rise** is accelerating. **Storm surges** intensify. **Sediment** budgets collapse. **Land** subsides. These dynamics interact. And *spatial planning* is where they must be managed together.

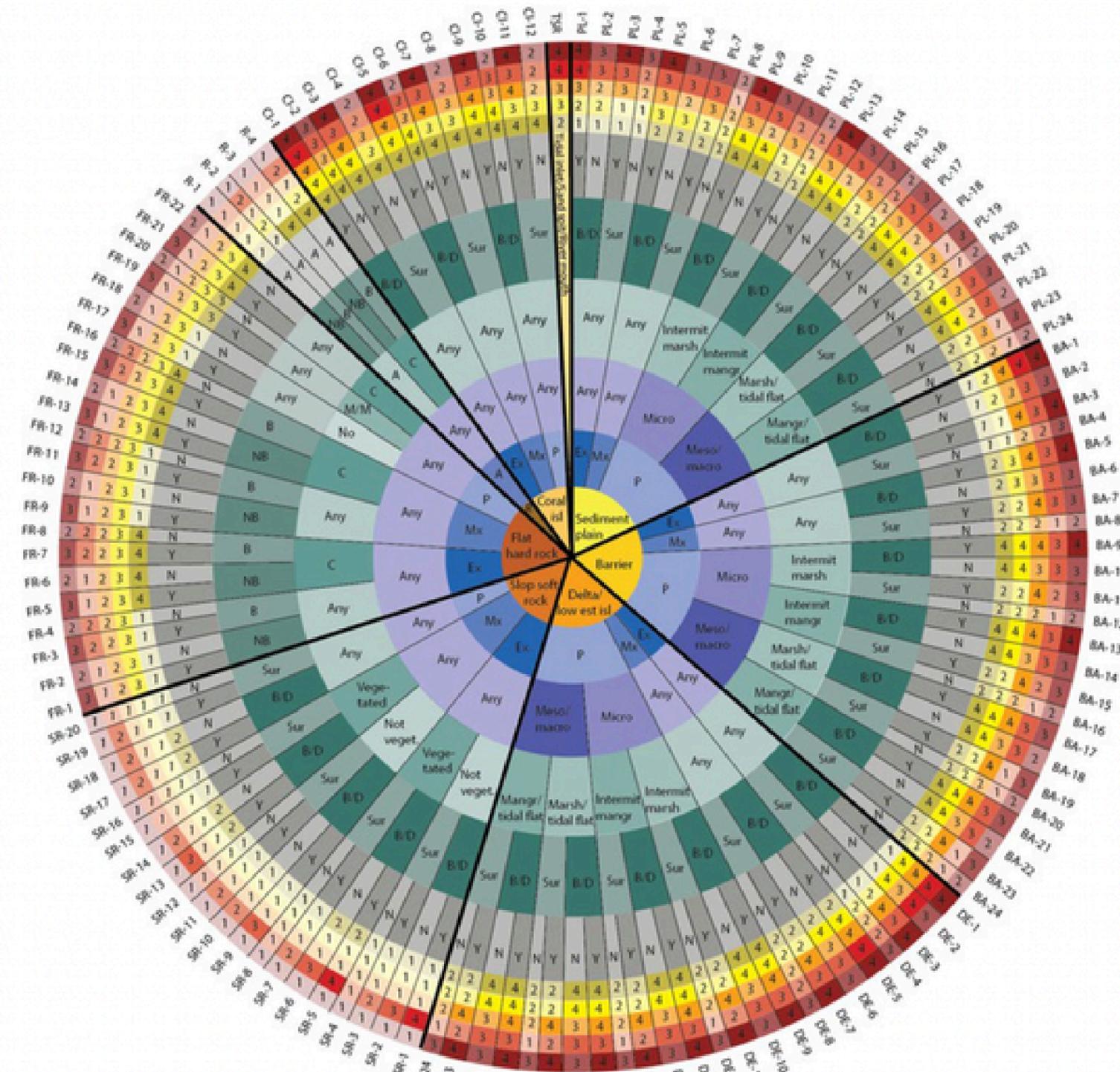
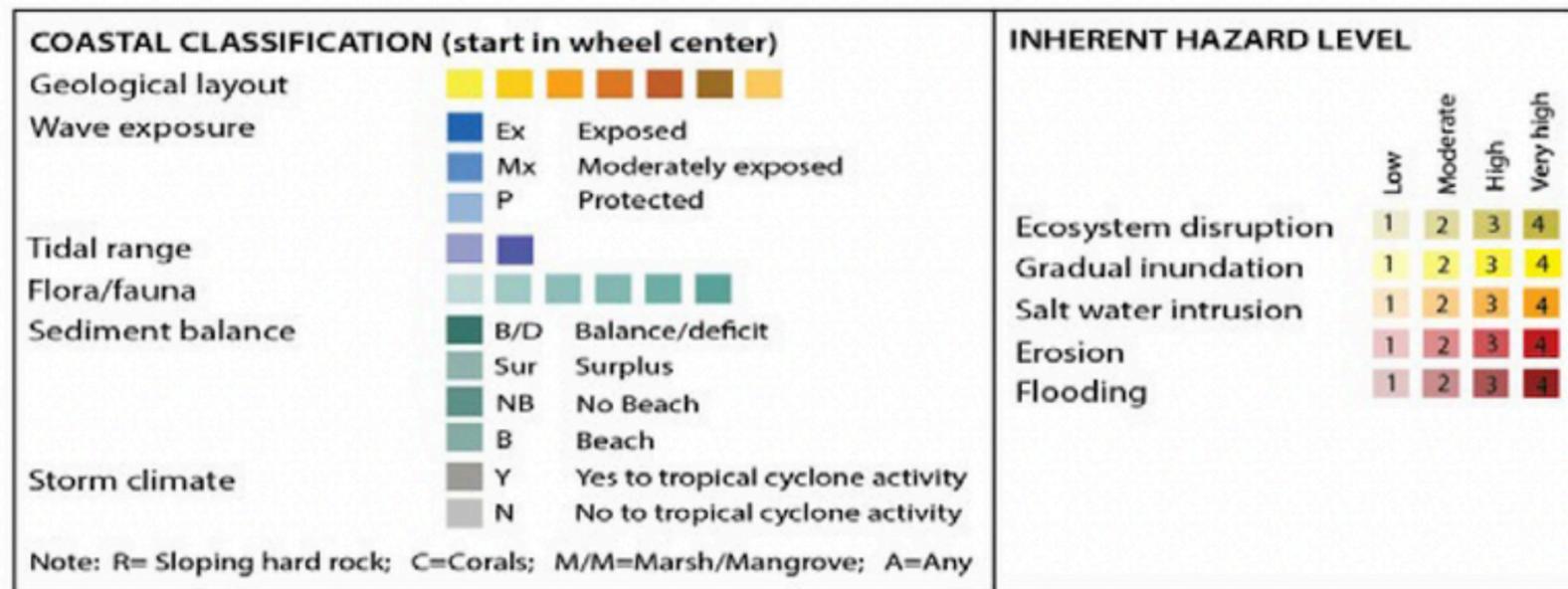
## Every tonne of CO<sub>2</sub> emissions adds to global warming

Global surface temperature increase since 1850-1900 (°C) as a function of cumulative CO<sub>2</sub> emissions (GtCO<sub>2</sub>)



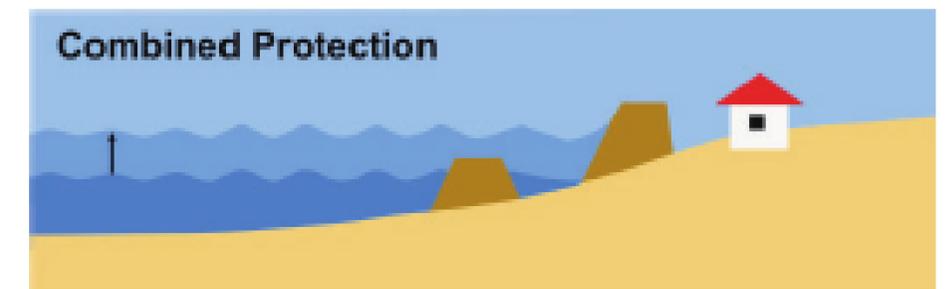
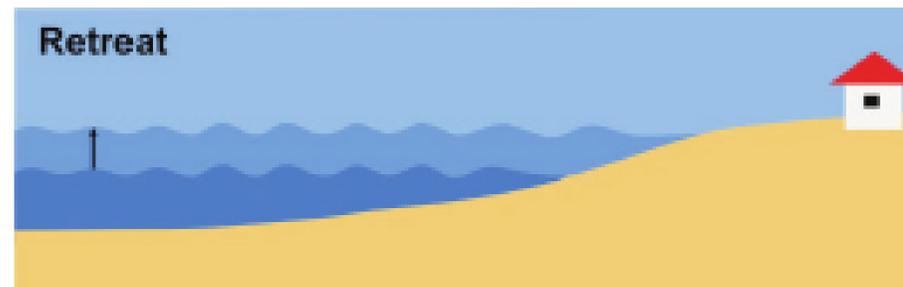
# Spatial Planning for coastal system

United Nations Environment Programme (UNEP), Coastal Hazard Wheel. This tool provides an overview of the main hazards based on coastline types. Source: (Rosendahl Appelquist, Balstrøm, Halsnæs, 2016).



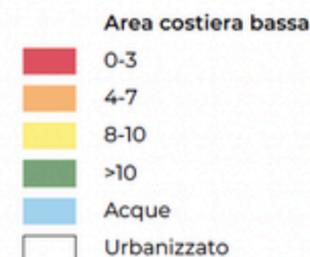
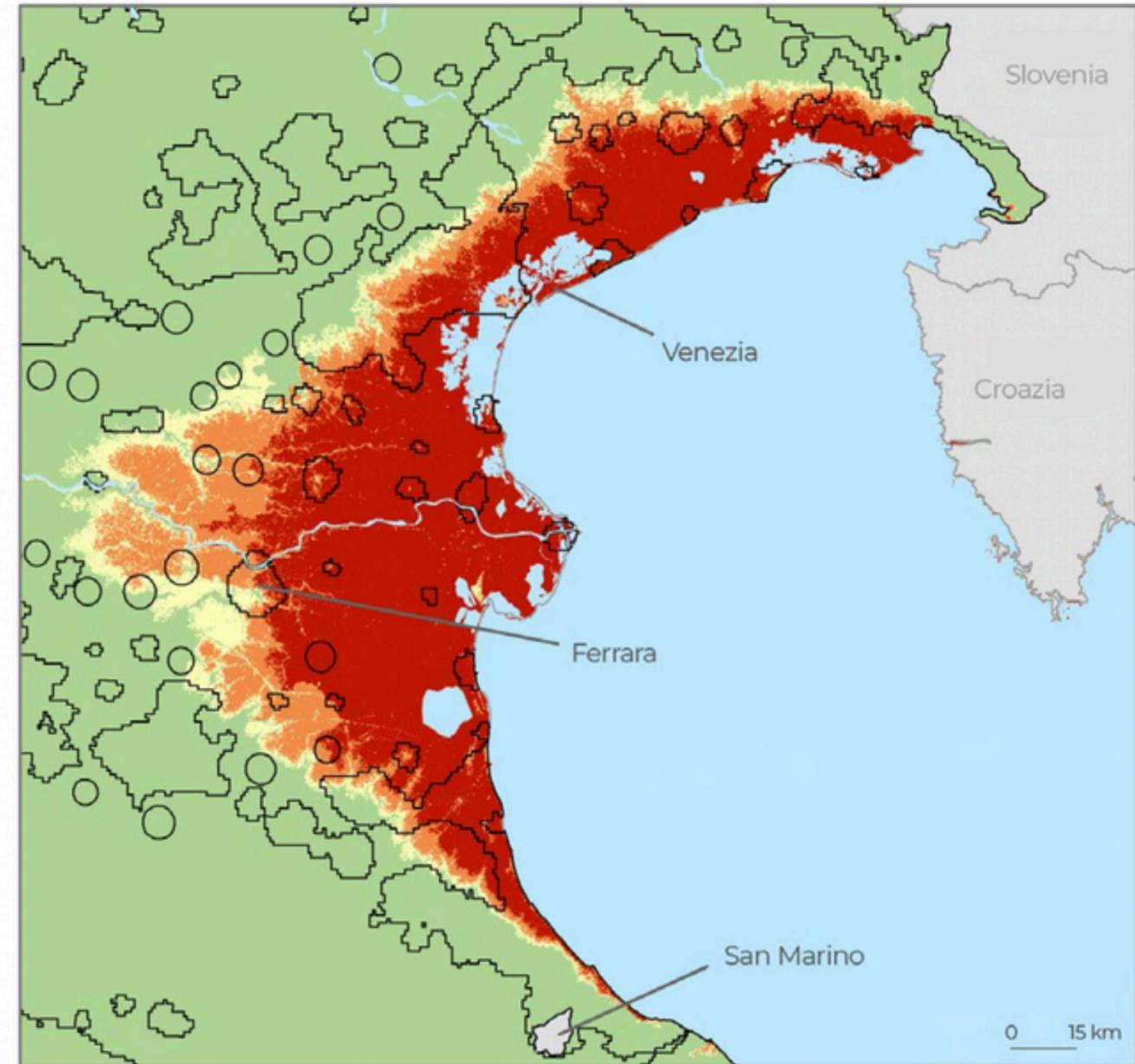
# Adaptation strategies with planning outputs

IPCC adaptation strategies are measures and actions taken to **reduce vulnerability to the impacts of climate change**. These strategies can be categorized as **infrastructural** (e.g., building seawalls), **institutional** (e.g., creating new insurance schemes), **behavioral** (e.g., changing crop planting times), and **nature-based-solutions** (e.g., restoring forests). The goal is to manage both current climate impacts and prepare for future climate change scenarios



# Spatial Planning for coastal system

Upper Adriatic. Low Elevation Coastal Zone (LECZ), identified on the basis of different continuous bands of elevation above sea level. Source: (Columbia University, Centre for International Earth Science Information Network, 2013).

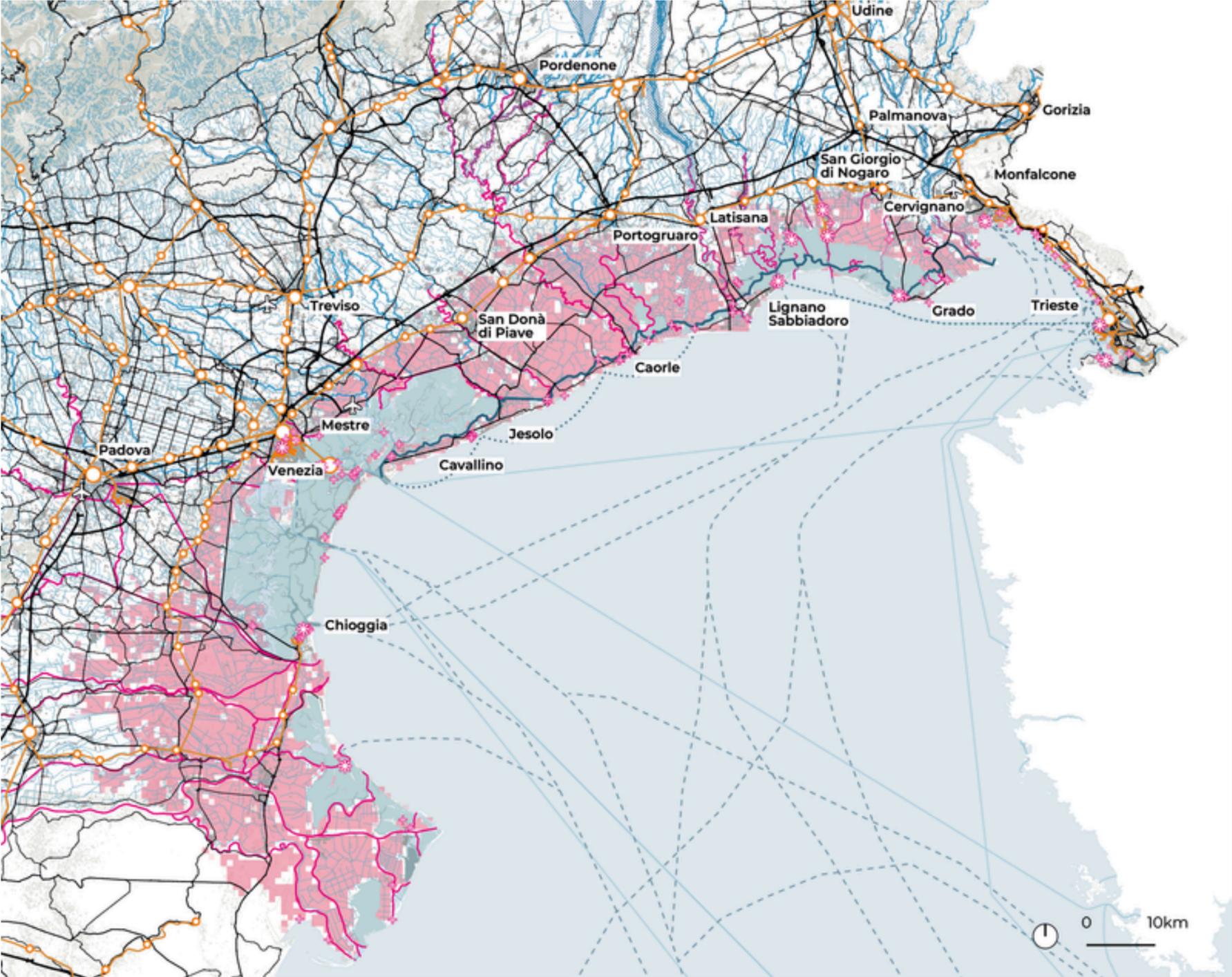
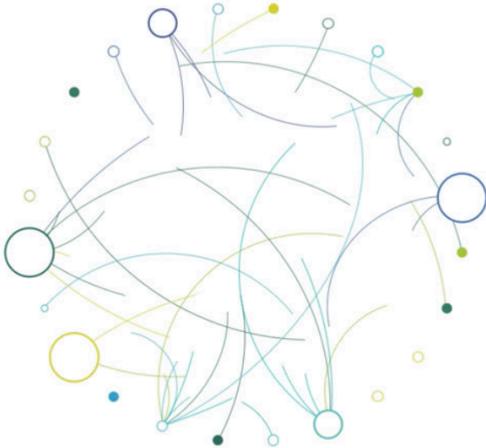


Regional (coastal) level:  
a wide buffer on coastal system:  
*areas between -5 and +1,4 on sea level.*

Concentration of infrastructures,  
networks and urban areas along  
the coastal buffer/risk sea level rise

## Northern Adriatic

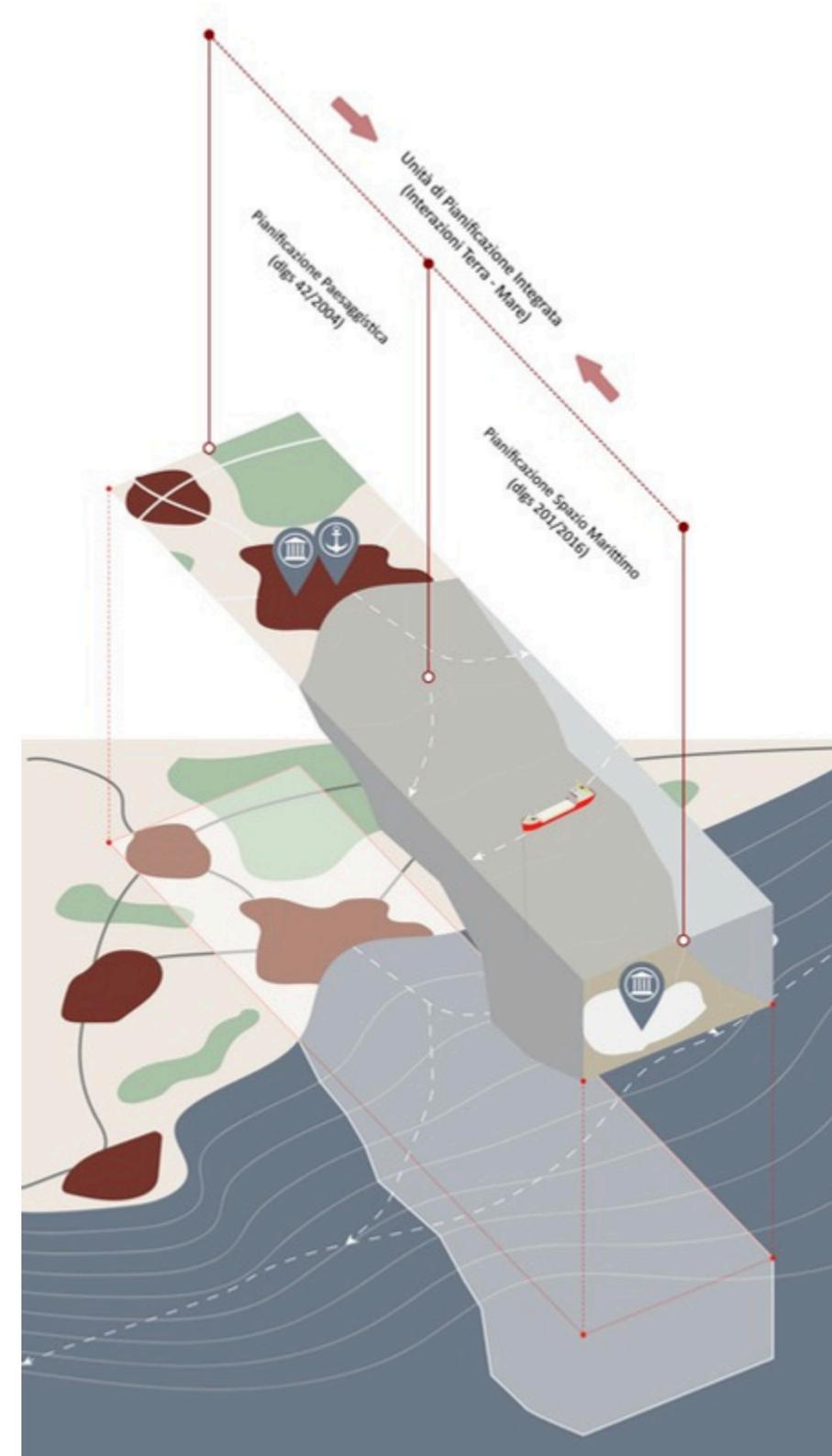
Source iNEST Iuv-Units SP8, 2024



# Land sea interactions

It is essential to establish a base knowledge on the Land–Sea Interactions discourse to support and manage the coastal and maritime spatial planning processes. Such an approach will contribute to dealing with the increasing pressure on both the **sea and coastal areas** by improving synergies and reducing conflicts. Moreover, the issue of climate change is inextricably linked with coastal zones and their own interactions.

The continuity of spatial planning is an asset for integration of spatial planning domain

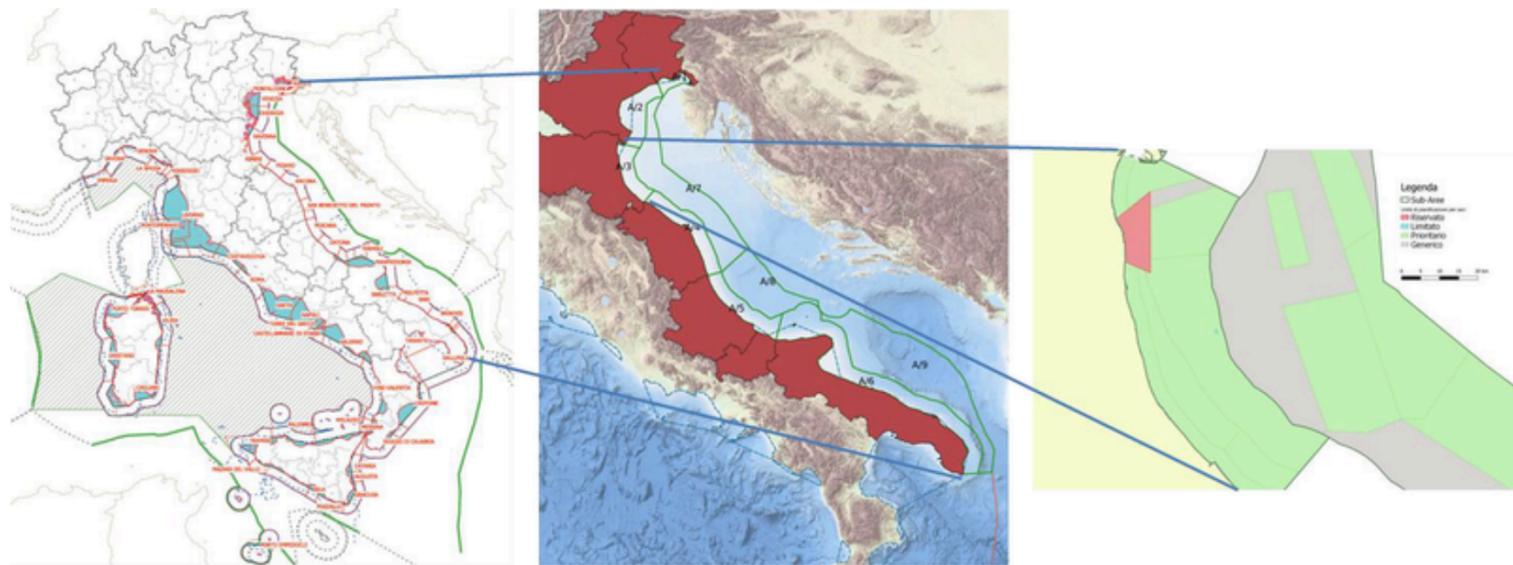




# Maritime Spatial Planning

Maritime spatial planning as a tool to support continuity of spatial management between coast and maritime regions.

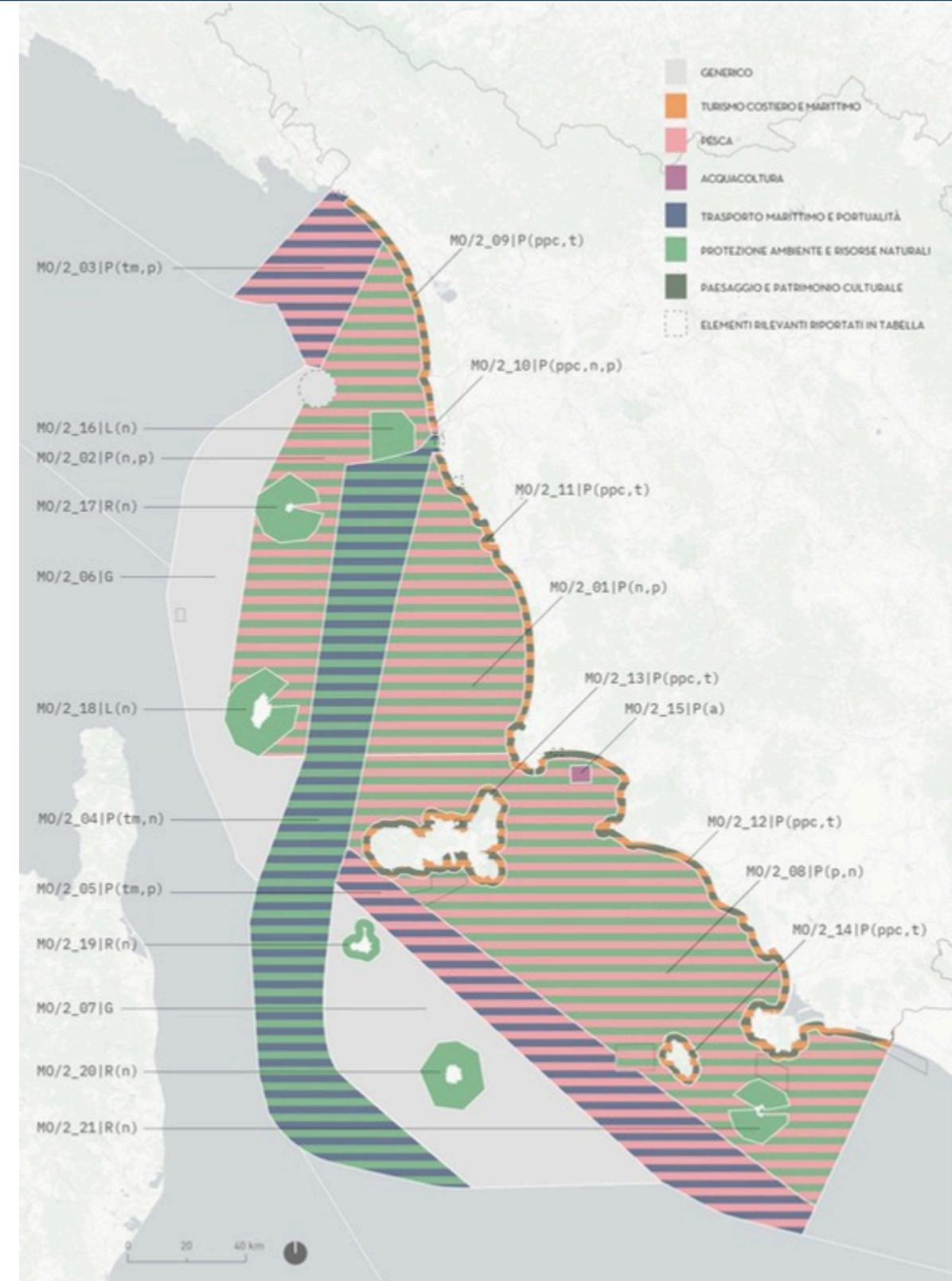
Source: *Italian Maritime Spatial Plan, MIT, elaborations CNR-Iuav- Corila (2024)*



Aree Marittime  
(Adriatico, Ionio-Mediterraneo  
Centrale, Tirreno-Mediterraneo  
Occidentale)

Sub-Aree  
(A/1 – A/9)

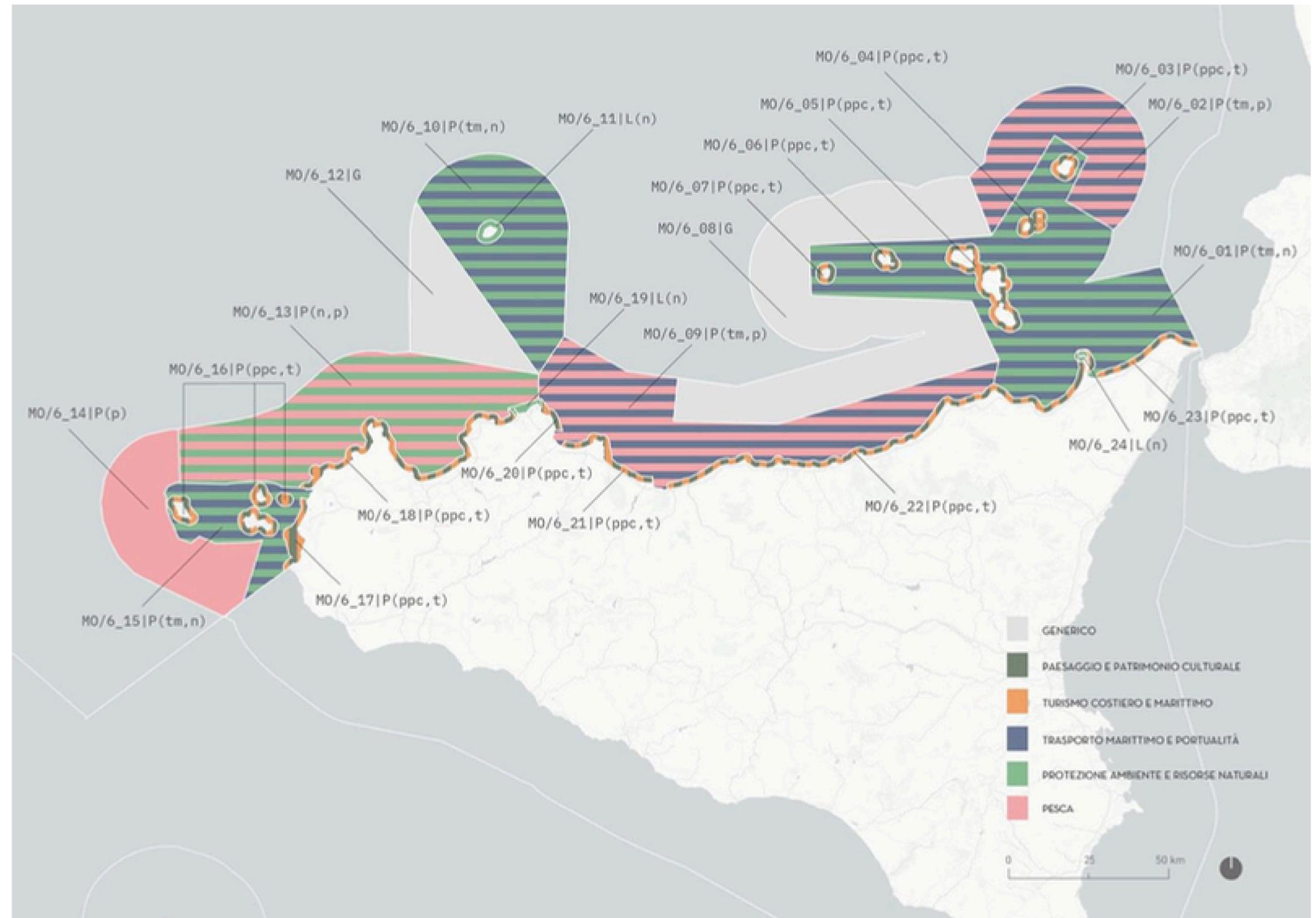
Unità di Pianificazione  
(usi Generici, Prioritari,  
Limitati, Riservati)



# Maritime Spatial Planning

A proper management of the interphase, supporting a spatial continuity of planning measures between land and sea is one the aim of maritime spatial planning.

*Source: Italian Maritime Spatial Plan, MIT, elaborations CNR-Iuav- Corila (2024)*



## TRASPORTO MARITTIMO E PORTUALITÀ

L'Adriatico italiano rappresenta una delle vie marittime più importanti per il transito di merci dall'Asia, via Suez, all'Europa grazie alla presenza di importanti porti.

Ad es. Venezia, Trieste, Ravenna, Ancona, Bari. Stabile aumento del trasporto container per tutti i porti considerati.

**5**  
AUTORITÀ DI SISTEMA PORTUALE

## TURISMO

Tra le più importanti destinazioni del turismo costiero nel Mediterraneo, i flussi turistici nell'area sono in costante aumento negli ultimi 20 anni, con continua crescita degli arrivi.

Presenza diffusa di porti passeggero/croceristici e porti ed approdi per il diporto.

**166**  
PORTI TURISTICI

## ENERGIA

Elevata rilevanza strategica e socio-economica dell'estrazione di idrocarburi nell'area, sia per la sua dimensione transfrontaliera e che per le sue attuali e potenziali interazioni con altri usi e con componenti ambientali.

Potenzialità per lo sviluppo delle energie rinnovabili in mare.

**4**  
ZONE MARINE IDONEE ALLA RICERCA E COLTIVAZIONE DI IDROCARBURI

## SFORZO DI PESCA

Area di importanza strategica a livello nazionale ed internazionale, con porti pescherecci tra i più rilevanti per flotta e pescato (ad es. Chioggia, San Benedetto del Tronto).

Hot-spot di biodiversità mediterranea per endemismi di specie ittiche, con presenza di importanti aree di riproduzione e crescita di specie alleliche a elevato valore commerciale

**2**  
GSA

## METODOLOGIA DI PIANIFICAZIONE DELL'AREA MARITTIMA ADRIATICO

- GENERICO
- ENERGIA
- DIFESA
- PESCA
- ACQUACOLTURA
- TURISMO COSTIERO E MARITTIMO
- PRELIEVO SABBIE RELIETE
- PAGGIAGGIO E PATRIMONIO CULTURALE
- PROTEZIONE AMBIENTE E RISORSE NATURALI
- TRASPORTO MARITTIMO E PORTUALITÀ
- SICUREZZA DELLA NAVIGAZIONE E MARITTIMA E SORVEGLIANZA



**86**  
TOT.

## UNITÀ DI PIANIFICAZIONE

- USO GENERICO
- USO PROIBITARIO
- USO LIMITATO
- USO RISERVATO

## TIPO DI USO



## ISTOGRAMMA RIASSUNTIVO USI E VOCAZIONALITÀ



## COESISTENZE USI PRIORITARI



## TRASPORTO MARITTIMO E PORTUALITÀ

Area di importanza strategica per tutti i tipi di traffici marittimi: canale di Sicilia (traffico commerciale internazionale Bosforo/Suez-Gibilterra), Stretto di Messina (collegamenti tra Mediterraneo orientale/Ionio e Tirreno); collegamenti con le isole: Pantelleria, Pelagie, Malta.



4  
AUTORITÀ  
DI SISTEMA  
PORTUALE



## PAESAGGIO E PATRIMONIO CULTURALE

Area di importanza mondiale per i beni culturali, paesaggistici ed archeologici. Siracusa è sito UNESCO, Marsala, Pantelleria, Capo Passero, Noto, Aci Trezza, Taormina sono siti di enorme interesse per il patrimonio culturale, incluso il patrimonio archeologico subacqueo.



169  
BENI PAESAGGISTICI  
CULTURALI ARCHEOLOGICI



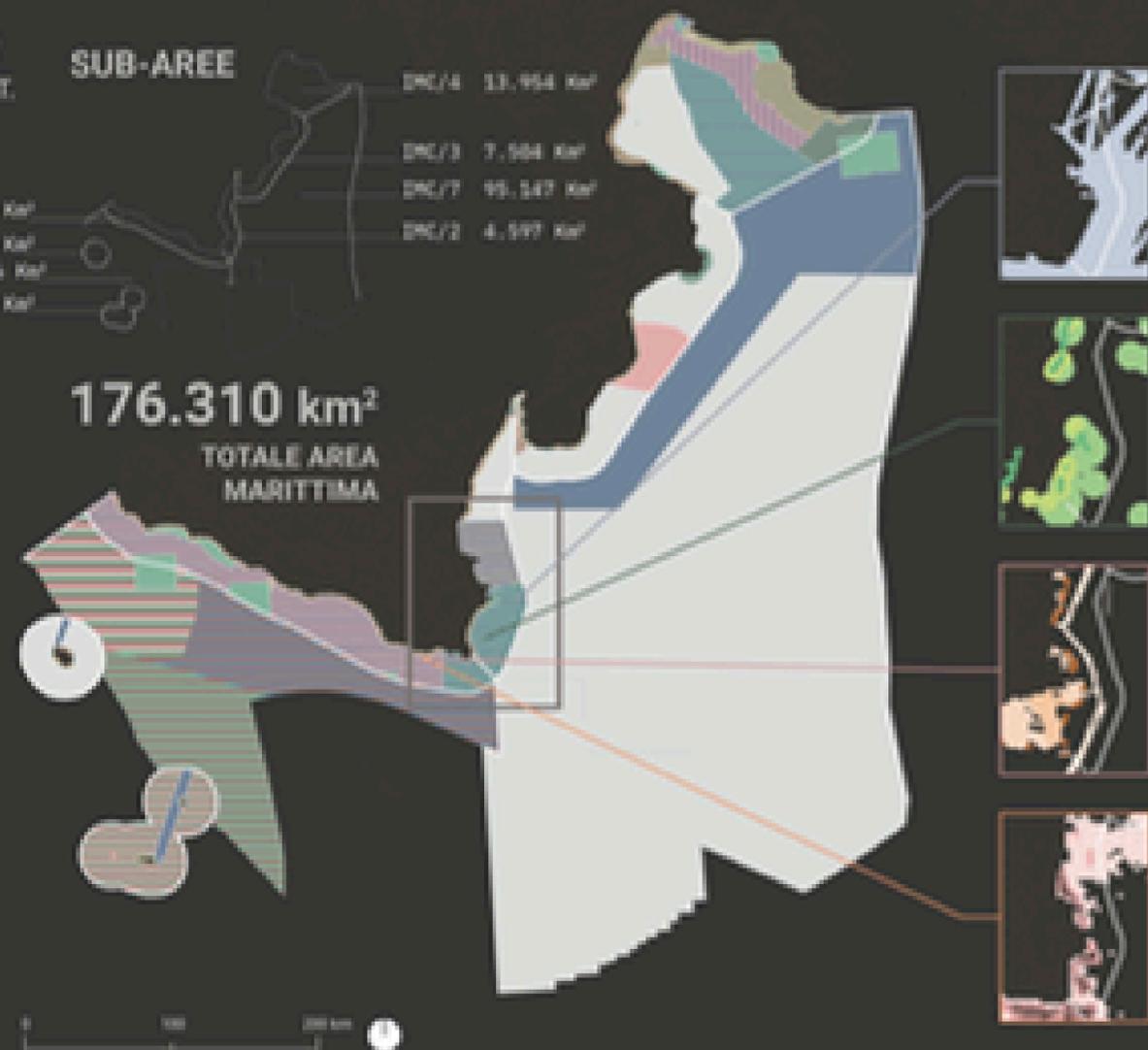
## METODOLOGIA DI PIANIFICAZIONE DELL'AREA MARITTIMA IONIO-MEDITERRANEO CENTRALE

- GENERICO
- DEFESA
- PESCA
- ACQUACOLTURA
- TURISMO COSTIERO E MARITTIMO
- PRELIEVO SABBIE RELITTE
- PAESAGGIO E PATRIMONIO CULTURALE
- PROTEZIONE AMBIENTE E RISORSE NATURALI
- TRASPORTO MARITTIMO E PORTUALITÀ
- SECUREZZA DELLA NAVIGAZIONE E MARI TTIMA E SOVRANITÀ

9  
TOT.  
SUB-AREE

DNC/1	7.793 Km²
DNC/5	2.427 Km²
DNC/6	23.816 Km²
DNC/9	4.858 Km²
DNC/4	13.954 Km²
DNC/3	7.584 Km²
DNC/7	19.247 Km²
DNC/2	4.597 Km²

176.310 km<sup>2</sup>  
TOTALE AREA  
MARITTIMA



## TURISMO

Intera area ospita siti costieri di grande rilevanza per il turismo balneare, nautico, culturale ed ambientale con grande potenziale di sviluppo per il turismo sostenibile.



56  
PORTI TURISTICI



## SFORZO DI PESCA

Area di importanza strategica a livello nazionale ed internazionale. Mazara del Vallo è il principale porto peschereccio italiano. Presenza di importanti aree di riproduzione e crescita di specie a elevato valore commerciale.



2  
GSA



## UNITÀ DI PIANIFICAZIONE

61  
TOT.

- USO GENERICO
- USO PRIORITARIO
- USO LIMITATO
- USO RISERVATO

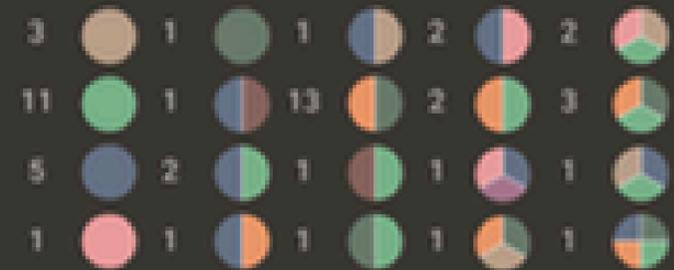
## TIPO DI USO



## ISTOGRAMMA RIASSUNTIVO USI E VOCAZIONALITÀ



## COESISTENZE USI PRIORITARI



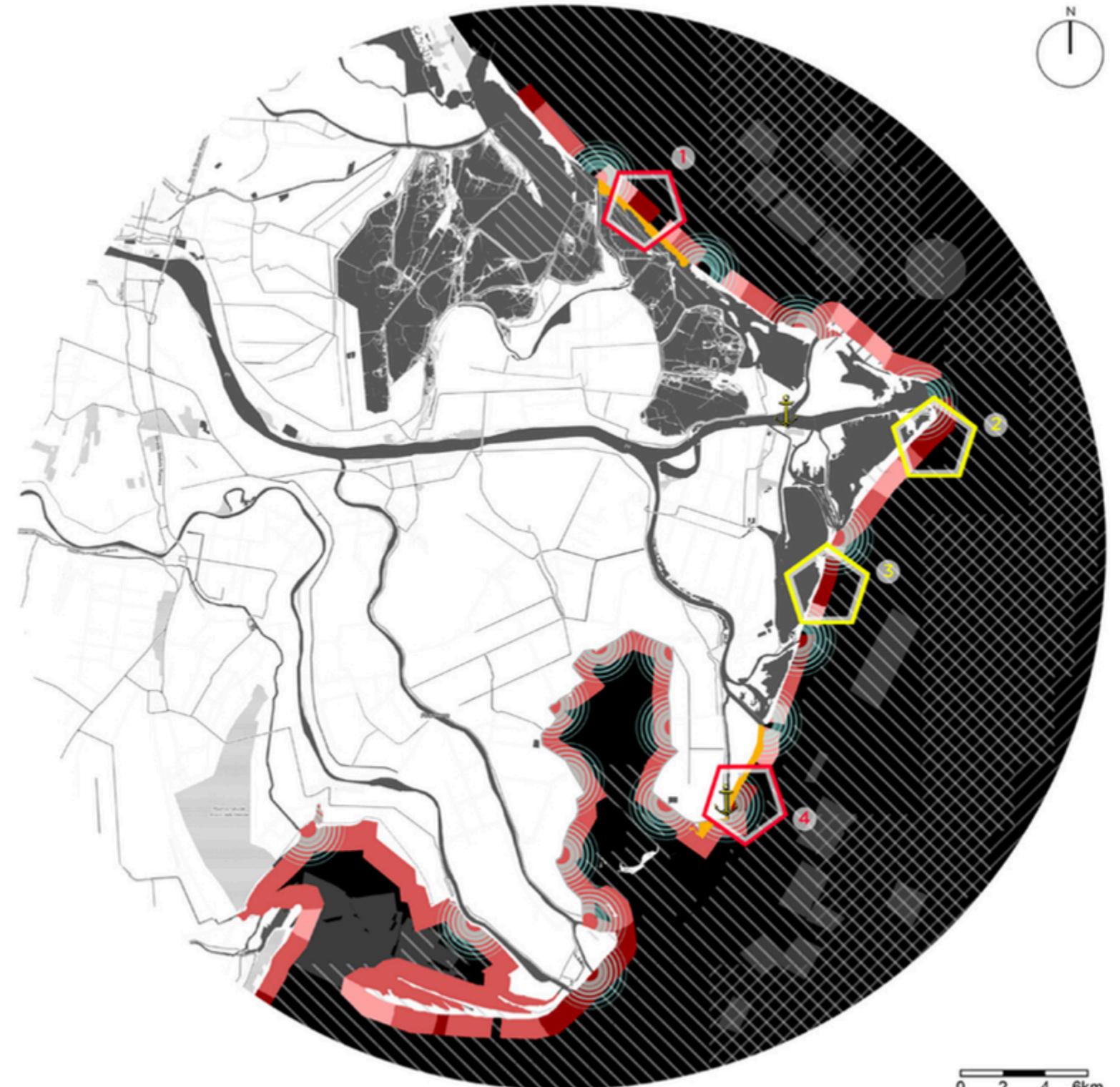
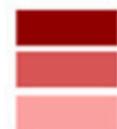


# Delta Po

- Experiments in managed realignment, allowing selected areas to be **intentionally flooded** to relieve pressure on embankments.
- **Wetland restoration** projects in the Sacca di Goro and other lagoons.

(source Appiotti F. Magni F., Musco. F. (2023) // *Delta che cambia*, Il Poligrafo)

Erosion  
Stability  
Accumulation



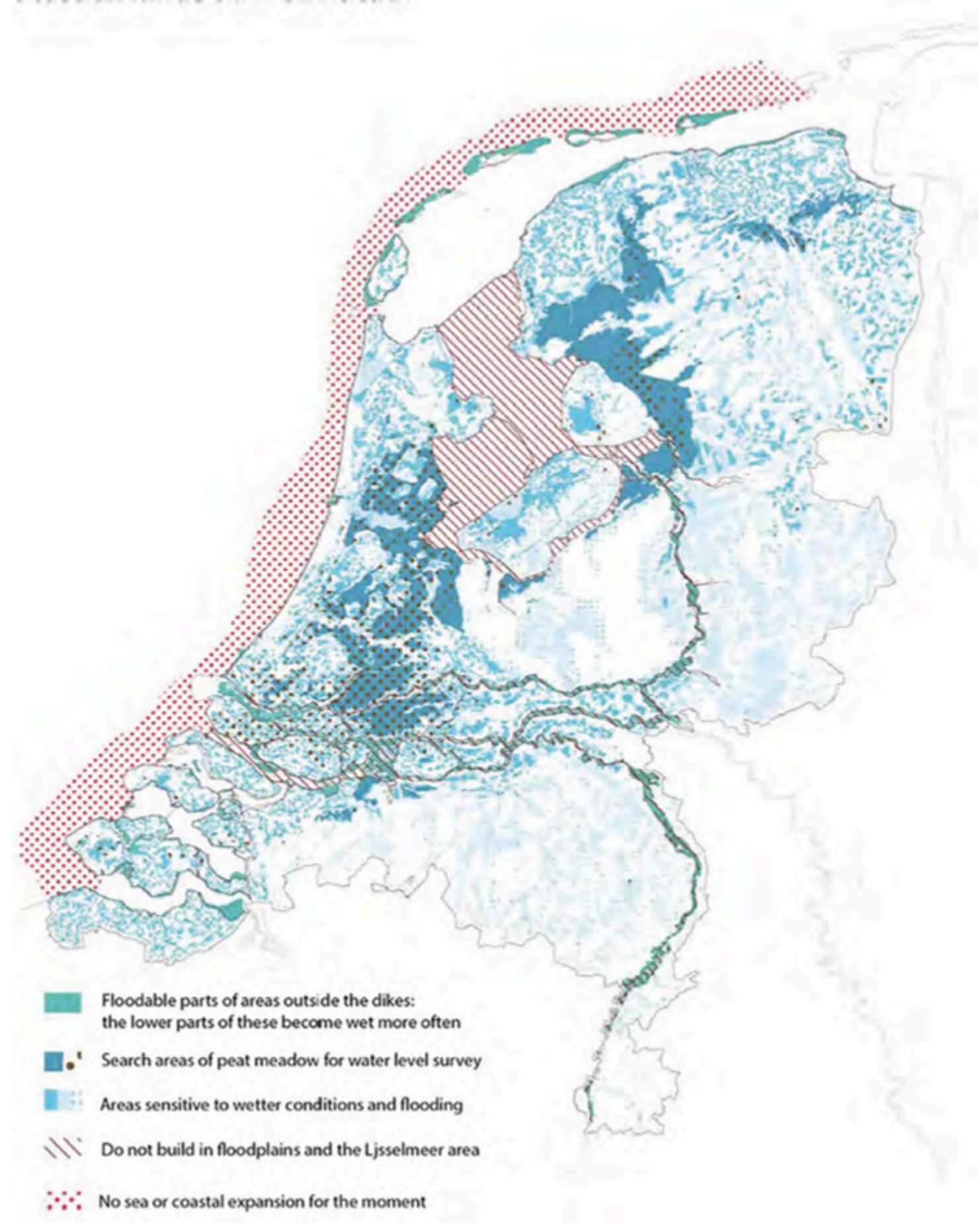
0 2 4 6km



# Rotterdam and Dutch Delta

The **Delta Programme 2024** and the new Nota Ruimte introduce key principles:

- No expansion of the coastline, to preserve sediment dynamics.
- Creation of **river buffer zones** for overflow and nature development.
- Use of adaptive pathways: **planning decisions linked to thresholds such as +1 m, +2 m, +3 m of sea-level rise.**



# Rotterdam and Dutch Delta

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The **Sand Motor**, a Dutch mega-nourishment project implemented in 2011, formed a hook-shaped peninsula to protect the coastline, mitigate sea-level rise, and create recreational and ecological spaces.

Equivalent to 20 years of regular nourishment, it is achieving its goals of coastal preservation, habitat creation, and leisure opportunities.



# Rotterdam and Duch Delta

The Keilehaven **Tidal Park in Rotterdam** is a pioneering example of how sustainable urban development and rewilding can be combined.

The project combines the creation of a city park with the reintroduction of a natural estuarine system in an urban setting. This results in an **innovative public space** where the delta's tidal landscape becomes visible and tangible.

*floating neighbourhoods and offices,  
adaptive public spaces,  
temporary uses,  
ecological infrastructures*



# Coastal adaptation is a spatial choice

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*How can we transform the challenge of sea-level rise into an opportunity to strengthen the bond between city and inhabitants? — is precisely the question spatial planning must address.*

1. **Sediment and space** are the core adaptation resources.

Many coastlines lack both; thus governance of sediment transport becomes essential.

2. **Coastal adaptation** requires **long-term spatial strategies**, not short-term projects.

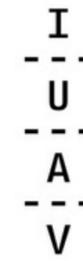
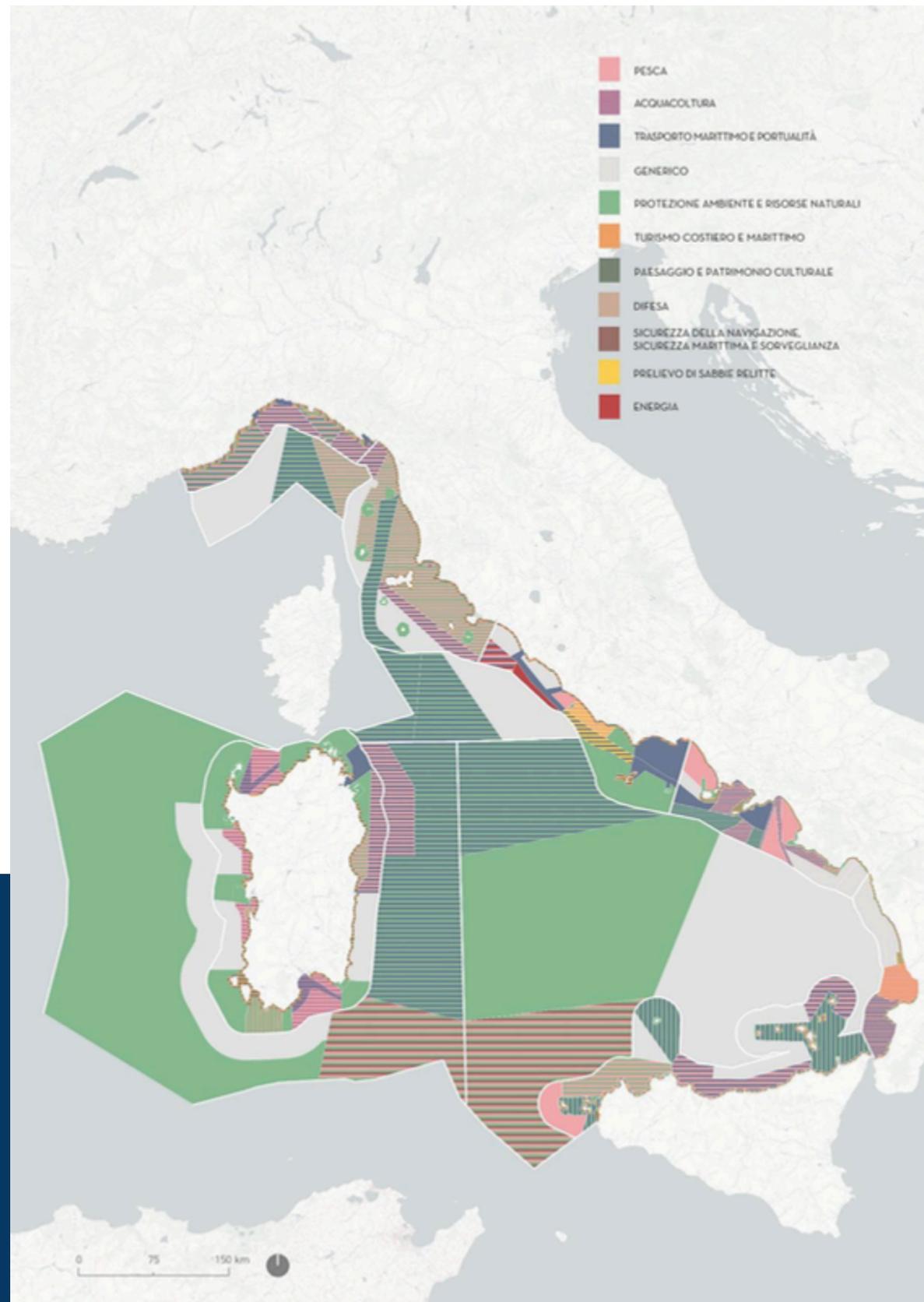
The Dutch example shows the importance of legally anchored long-term frameworks.

3. **Retreat is politically difficult** but increasingly necessary in selected locations.

The Po Delta experience demonstrates how retreat can be part of ecological enhancement.

4. **Adaptation is not only technical** — it is social, cultural, and political.

It requires communities to understand risks, accept transitions, and participate in decisions



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# Thank you

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