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# The role of the saltmarshes as Nature-based Solutions for the Climate Change adaptation in European Atlantic estuaries

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# Vulnerability of coastal areas
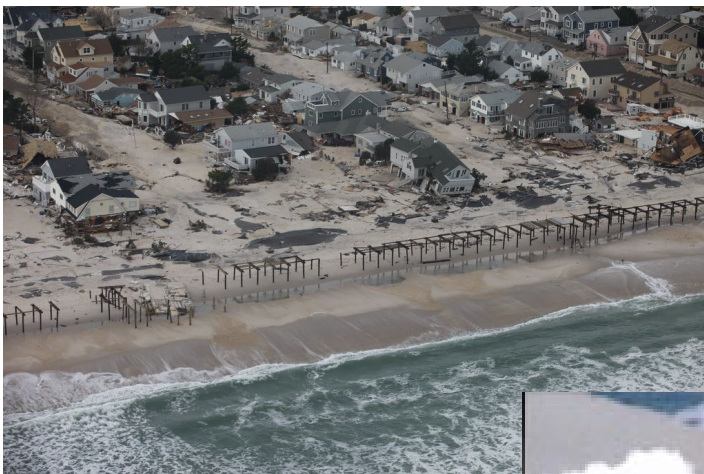


Projected changes, impacts and risks for ocean ecosystems as a result of climate change
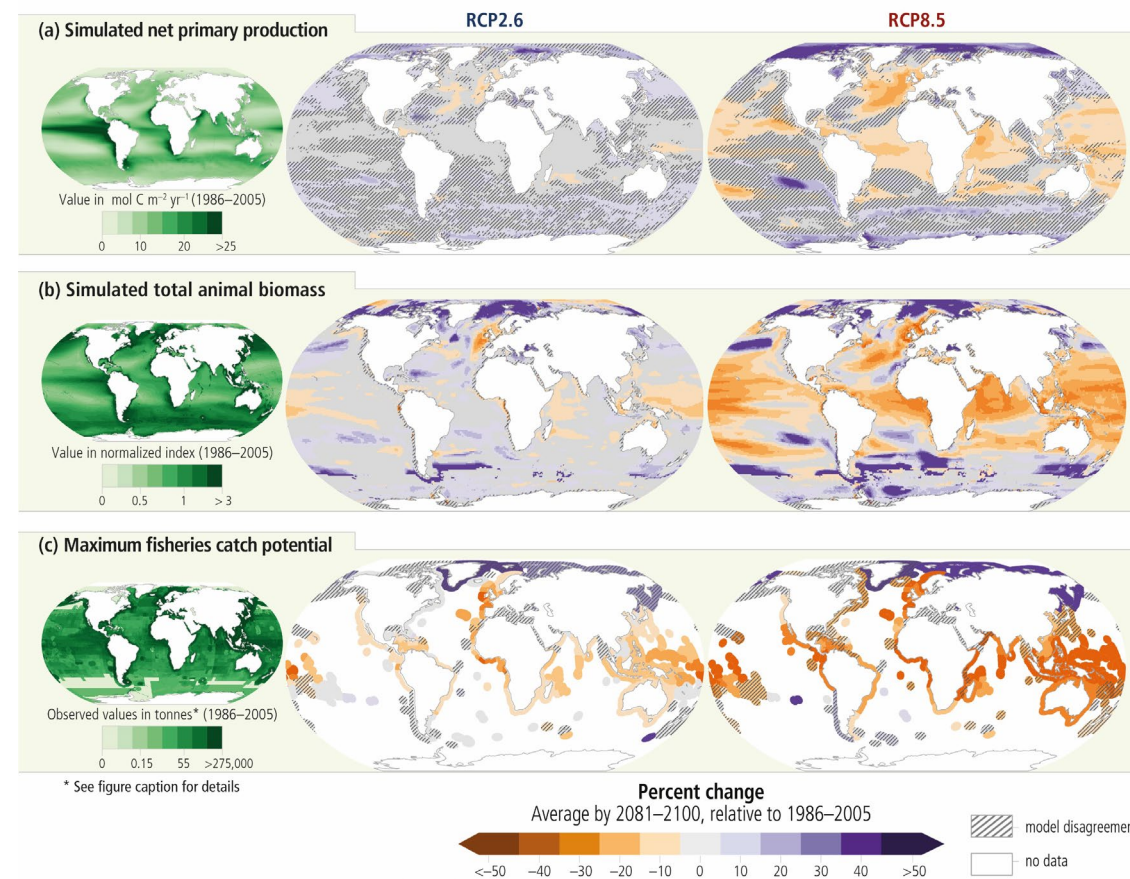
IPCC, 2019

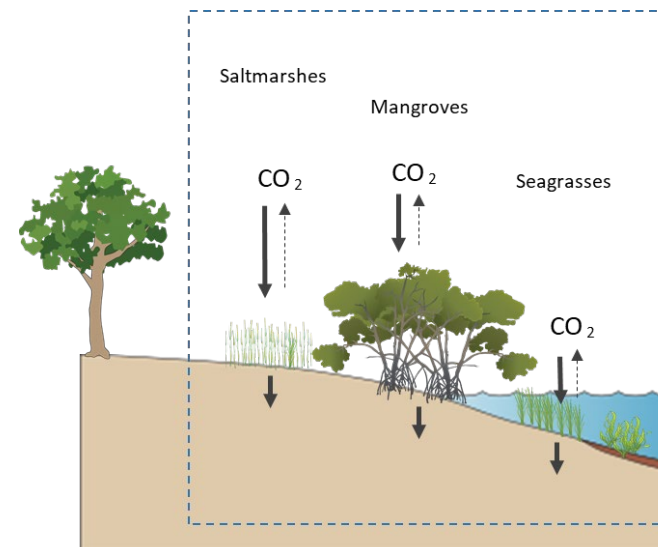# Estuarine vegetation as NbS

## Blue Carbon

*(CO$_2$ sequestration by estuarine ecosystems)*



Saltmarshes

Mangroves

CO$_2$    CO$_2$    Seagrasses

CO$_2$

## Protection

Wave attenuation

Accretion

# Objectives

To highlight the value of estuarine restoration actions as NbS to Climate change by the assessment of the impact of historical estuarine restoration actions in the Atlantic area of the Peninsula Ibérica in terms of:

- The coastal protection benefits provided by saltmarshes
- The carbon storage by saltmarshes

# Study area
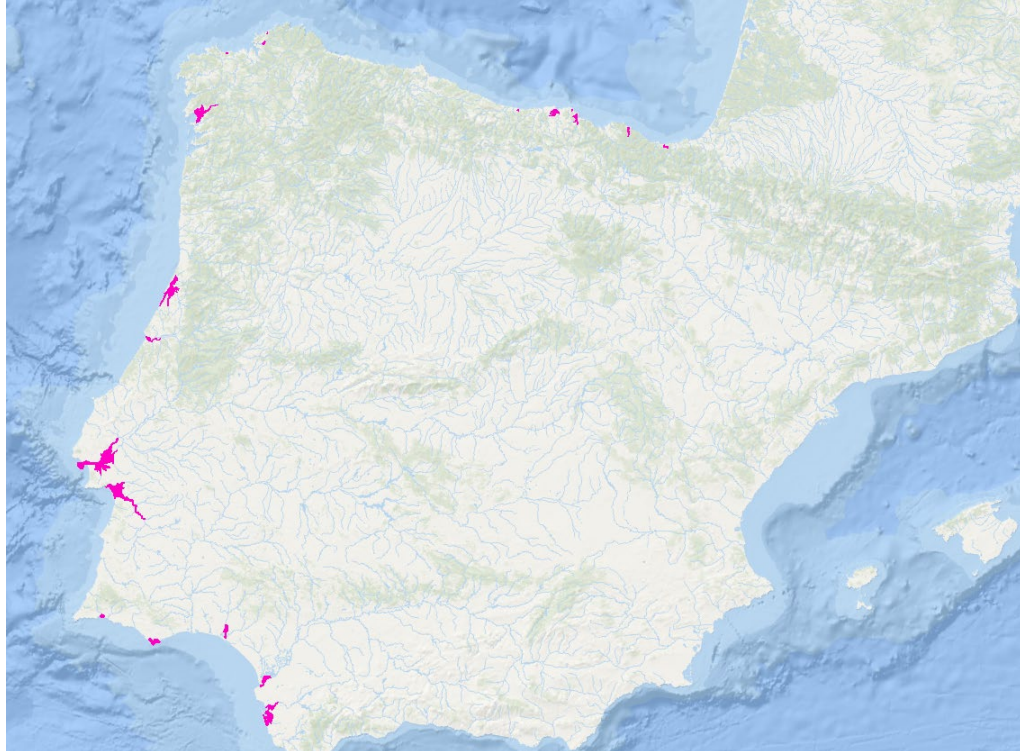


**20 study sites**

**8 Atlantic EU regions**
       Pais Vasco
       Cantabria
       Principado de Asturias
       Galicia
       Portugal Centro
       Lisboa
       Algarve
       Andalucía
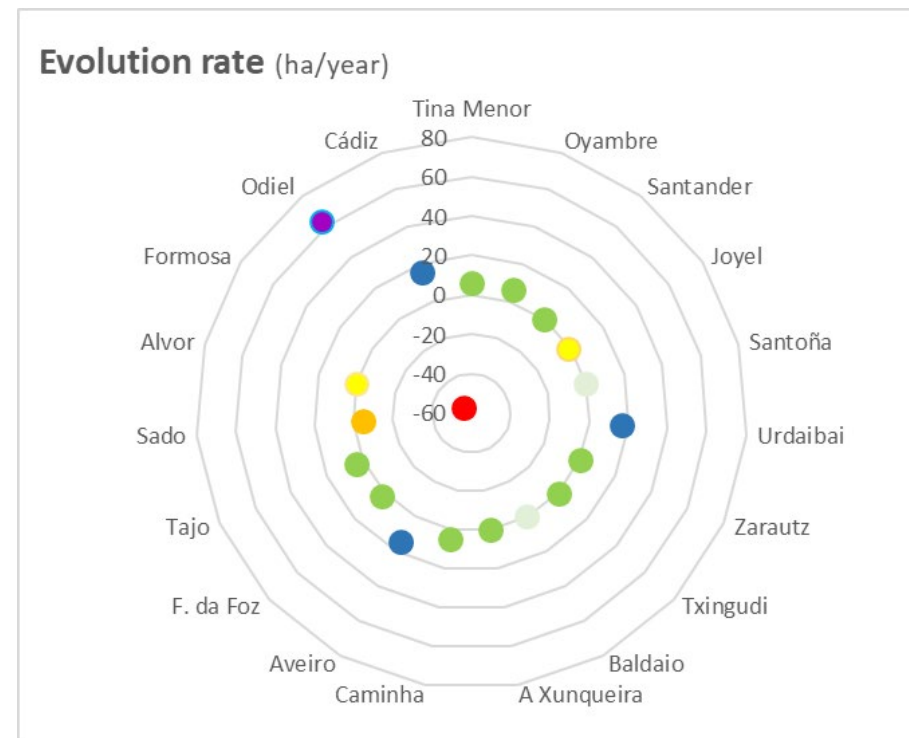
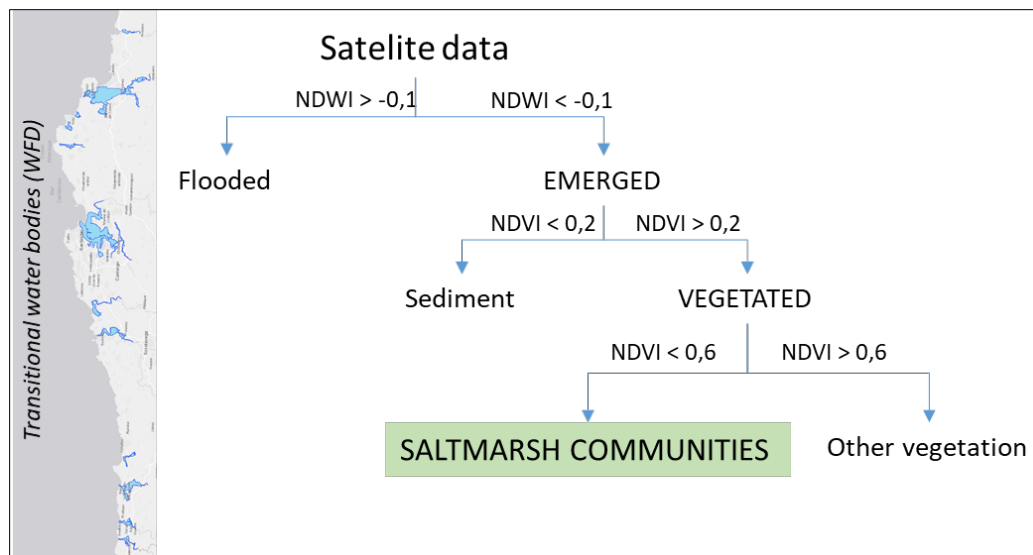Built Environment
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# Evolution of saltmarsh communities in restored areas
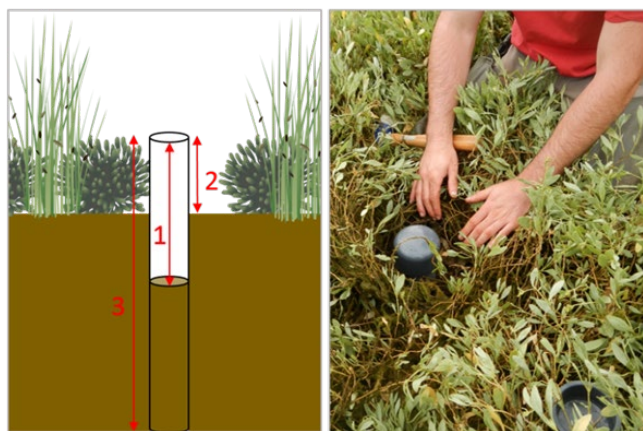
**Remote sensing data**

Sentinel 2 / Landsat

# Assessment of Ecosystem Services – Carbon storage
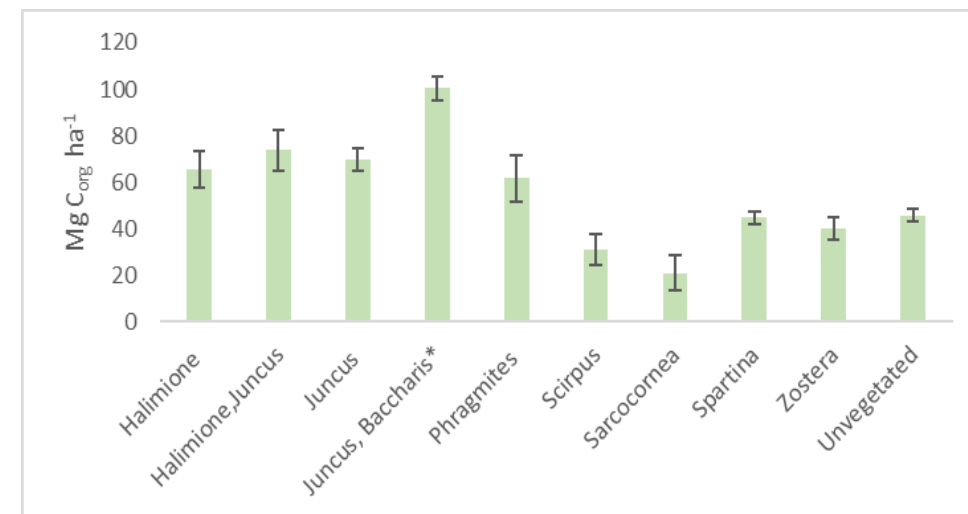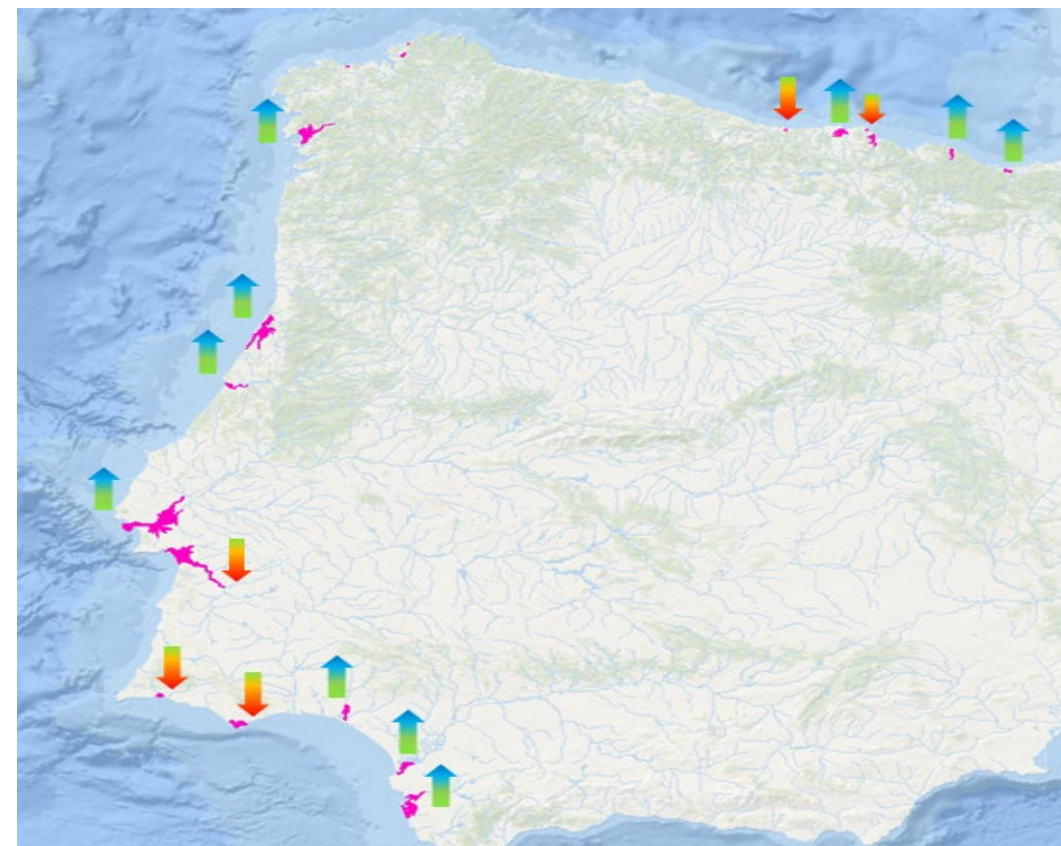


1. Sampling campaing

2. Lab processing

3. Average values of C stoks

# *Carbon storage*



**Saltmarshes area**

**Land use before restoration actions**

Saltponds    Non-vegetated Mudflats

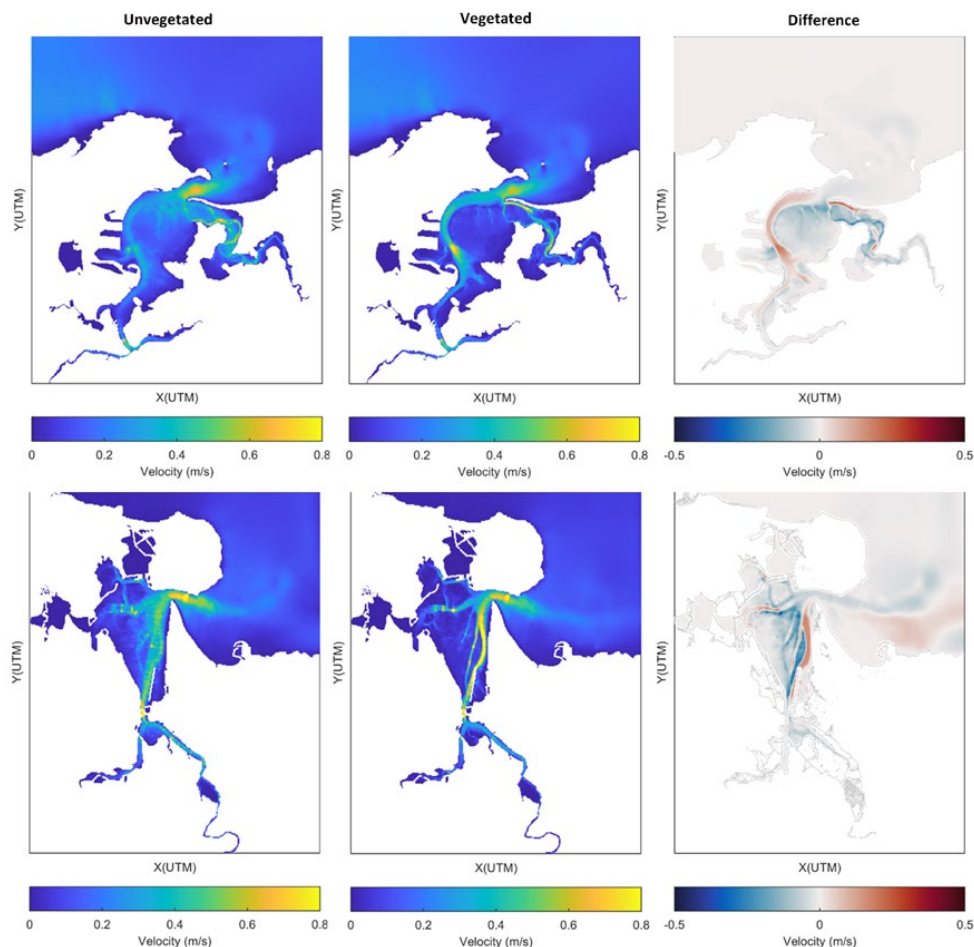*Baccharis halimifolia*

Variable according to the new communities

*Carbon storage*
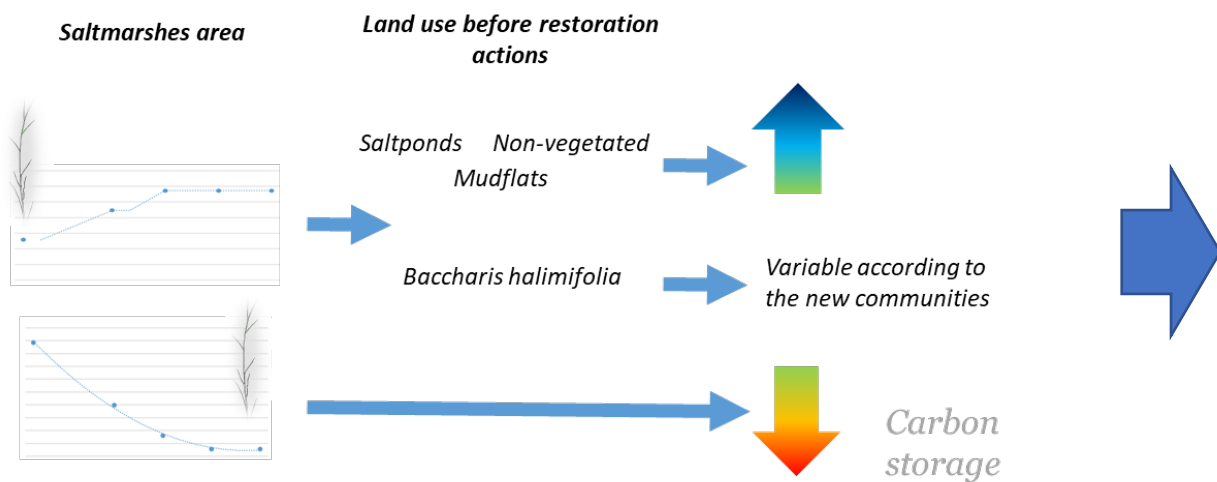
# Assessment of Ecosystem Services – Coastal defense
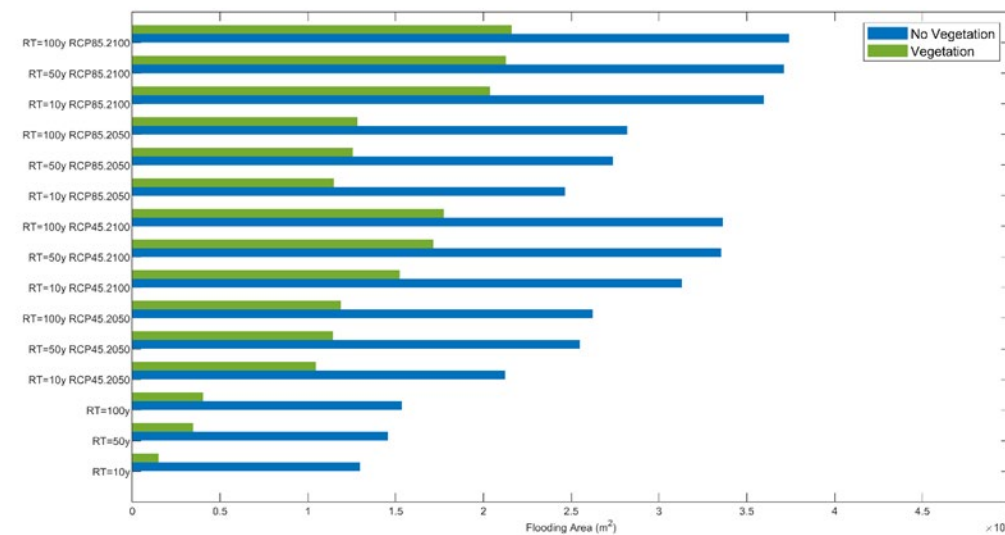


https://lifeadaptablues.eu/results/
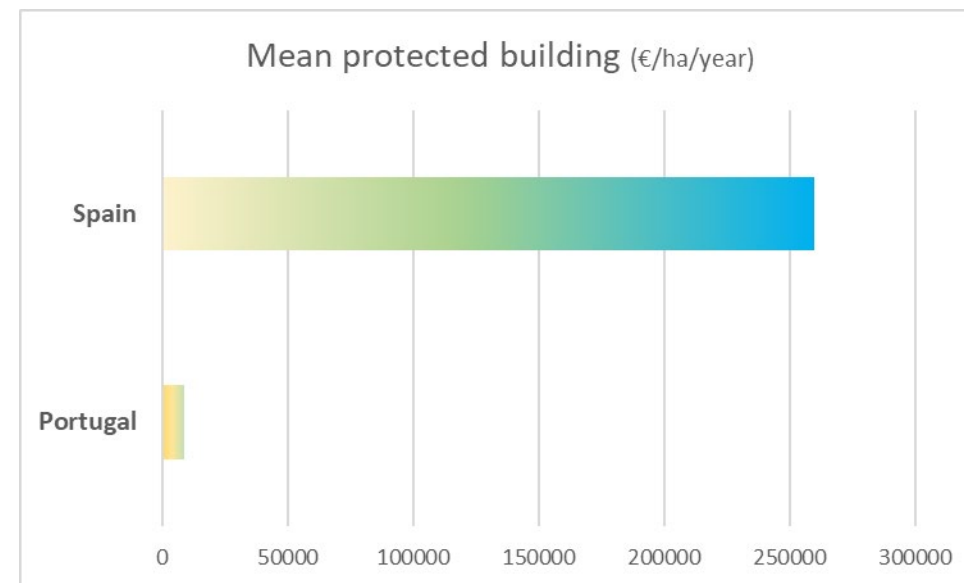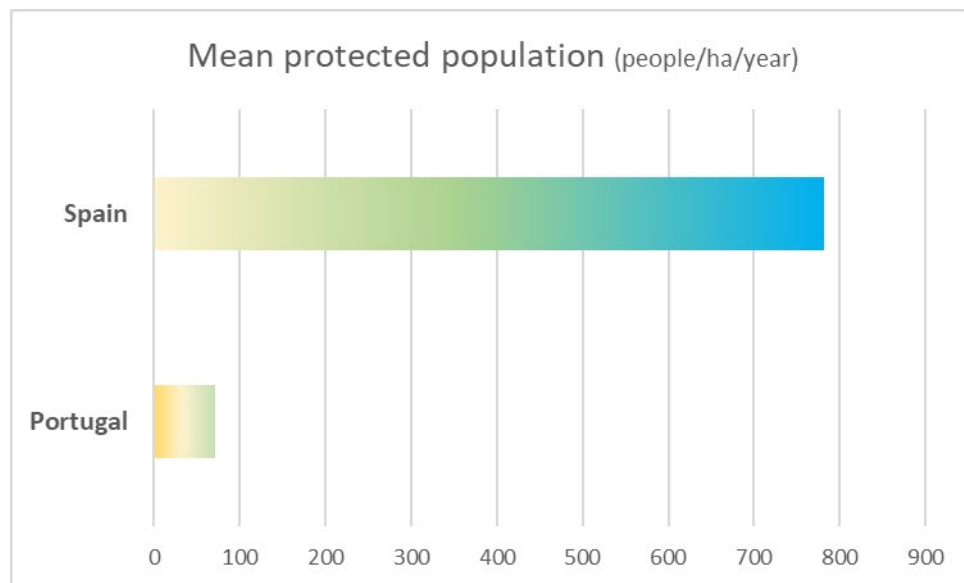
# *Coastal defense*

$$ESV = \sum (Ak * V\,Ck))$$

*ESV= Estimated total value of the ecosystem service, Ak=area (ha), and VCk= Value coefficient for the desired ecosystem (€/hectare/year)*

| | Name | Rate (ha/y) | Protected population (people/ha/y) | Protected building assess (€/ha/y) | Country |
|---|---|---|---|---|---|
| 1 | Alvor | -0.32 | -5 | -6,187 € | Portugal |
| 2 | Arousa | 0.29 | 53 | 9,690 € | Portugal |
| 3 | Aveiro | 14.64 | 103 | 20,837 € | Portugal |
| 4 | Cádiz | 15.42 | 2868 | 522,333 € | Spain |
| 5 | Caminha | 5.07 | 36 | 7,217 € | Portugal |
| 7 | Figueira da Foz | 2.18 | 405 | 73,812 € | Portugal |
| 8 | Formosa | -55.54 | 0 | -13,051 € | Portugal |
| 9 | Joyel | -0.51 | 0 | -119 € | Spain |
| 10 | Odiel | 63.02 | 945 | 1,212,999 € | Spain |
| 11 | Oyambre | 6.15 | 0 | 1,446 € | Spain |
| 12 | Sado | -5.11 | -77 | -98,304 € | Portugal |
| 13 | Marismas Blancas | 0.35 | 5 | 6,642 € | Spain |
| 14 | Tejo | 3.89 | 58 | 74,876 € | Portugal |
| 15 | Tina Menor | 6.24 | 0 | 1,466 € | Spain |
| 16 | Txingudi | 0.43 | 6 | 8,229 € | Spain |
| 17 | Urdibai | 17.22 | 3203 | 583,502 € | Spain |
| 18 | Zarautz | 0.18 | 3 | 3,438 € | Spain |

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# *Coastal defense*

# Conclusions

- The impact of the restoration actions in the carbon storage depends on the changes in saltmarsh extension but also on the changes in high marsh surface area in relation to other estuarine habitats.
- Estuarine systems offer different coastal protection capacity levels to population and infrastructures. Cádiz and Urdaibai have a protection capacity of 27% and 42% higher than the mean protection value of all the Spanish estuaries analyzed. The estuarine ecosystems in the Aveiro estuary quadruple their coastal protection capacity compared to the mean protection value of all the Portuguese estuaries analyzed.
- There area relevant differences between the Spanish study sites, where carbon sequestration and coastal protection services would have mostly increased, and the Portuguese study sites, where the greatest losses of these services have been estimated.
- Quantification of $C_{org}$ sequestration (stocks and burial rates) and coastal protection services provided by estuarine ecosystems before and after the implementation of different restoration actions (including the elimination of *Baccharis halimifolia*) is needed in order to better predict the outcomes of estuarine restoration projects

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# Thank you

This work has been developed within the European LIFE AdaptaBlues project

With the contribution of the LIFE
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