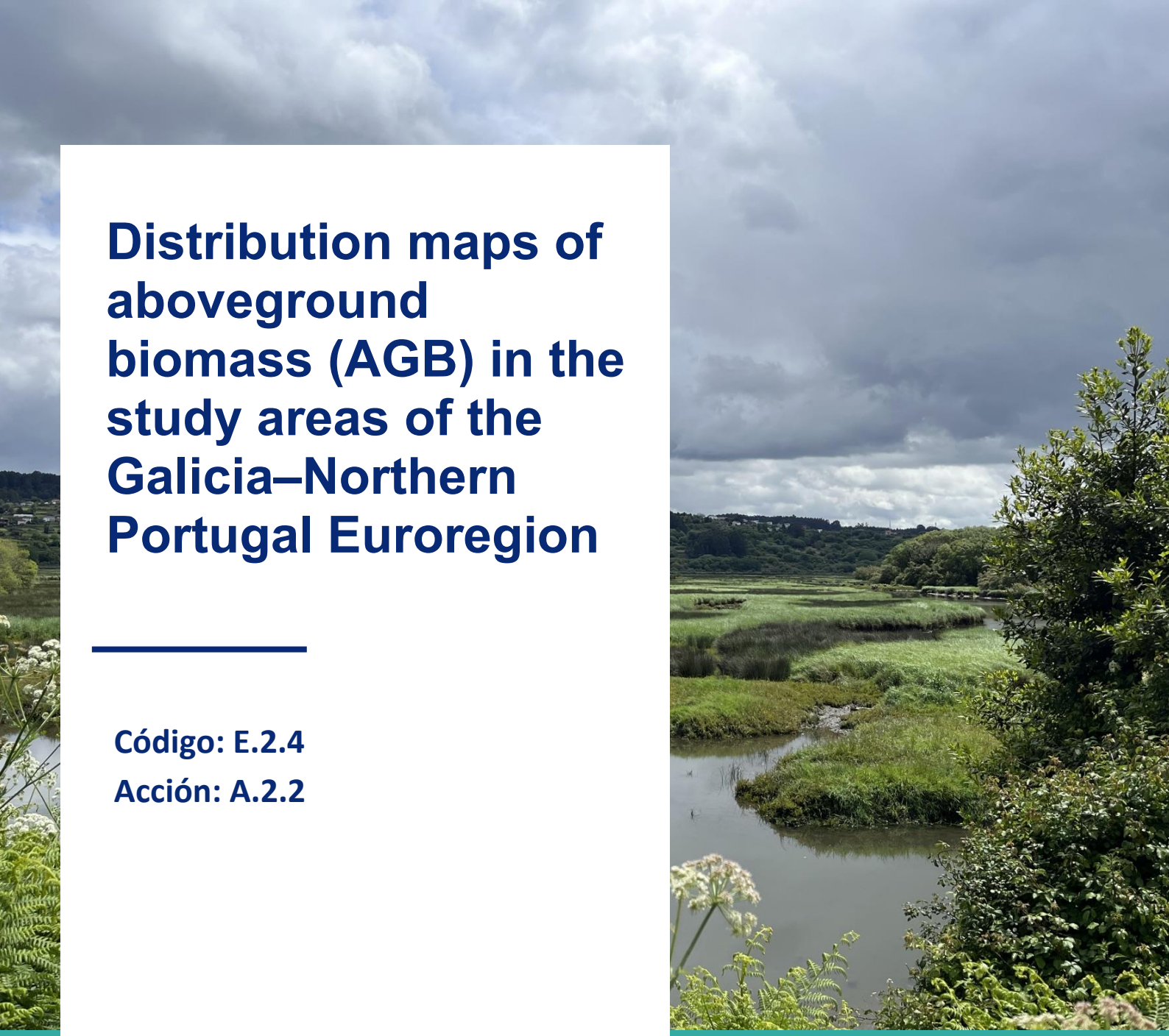

Distribution maps of aboveground biomass (AGB) in the study areas of the Galicia–Northern Portugal Euroregion

Código: E.2.4

Acción: A.2.2

Interreg

Cofinanciado por la Unión Europea
Cofinanciado pela União Europeia

España – Portugal

CAPTA

Cofinanciado por la Unión Europea a través del Programa Interreg VI-A España-Portugal (POCTEP) 2021-2027. Las opiniones son de exclusiva responsabilidad del autor que las emite.

Summary

1. Introduction

Coastal wetlands are among the most productive ecosystems on the planet, performing essential ecological functions for both biodiversity and human well-being. These intertidal environments act as natural barriers against storms and flooding, promote coastal protection, improve water quality, regulate biogeochemical cycles, and provide habitat for a wide diversity of species of ecological and economic importance (Alongi, 2020; Chastain et al., 2022). In addition, salt marshes are widely recognised as blue carbon ecosystems, with a high capacity to capture and store carbon in their soils and biomass (Macreadie et al., 2013; Radabaugh et al., 2018; Pham et al., 2019). In this way, they simultaneously contribute to climate change mitigation and to increased coastal resilience.

The mapping of salt marsh areas is essential to preserve them and to understand their behaviour through time. This deliverable presents the mapping of 11 salt marshes located in estuaries in Galicia and northern Portugal. Distribution maps were generated using existing information from government agencies and up-to-date high-resolution satellite images from the WorldView constellation.

2. Methodology

2.1 Study Area

The Galicia and northern Portugal euroregion contains significant intertidal areas, including salt marshes and seagrass meadows. The local climate is temperate, with a mean annual precipitation of approximately 1,200 mm. Sedimentary dynamics and the morphology of the studied area are strongly influenced by tides, rainfall, and human occupation along the margins (Perez-Arlucea et al., 2005), where urban infrastructure, agricultural areas, and artificial surfaces predominate. These anthropogenic pressures have reduced natural margins, thereby limiting the potential for salt marshes to migrate in response to sea-level rise. The study area comprises 11 salt marsh regions in Galicia and northern Portugal. The selection of regions was based on salt marsh areas, relevance, and availability of satellite images. The regions and the extend of the salt marsh areas (in ha) are presented in Table 1, and their geographical locations are shown in Image 1.

Table 1 – Regions and their salt marsh areas

Region	Area (ha)
BALDAIO	149,3
BETANZOS	298,7
CARREGAL	147,5
CAVADO	97,5
CORUNA	5,9
LIMA	249,1
MINHO	384,8
RAMALLOSA	64,4
ULLA	238,4
UMIA	319,5
VIGO	14,5
TOTAL	1969,6

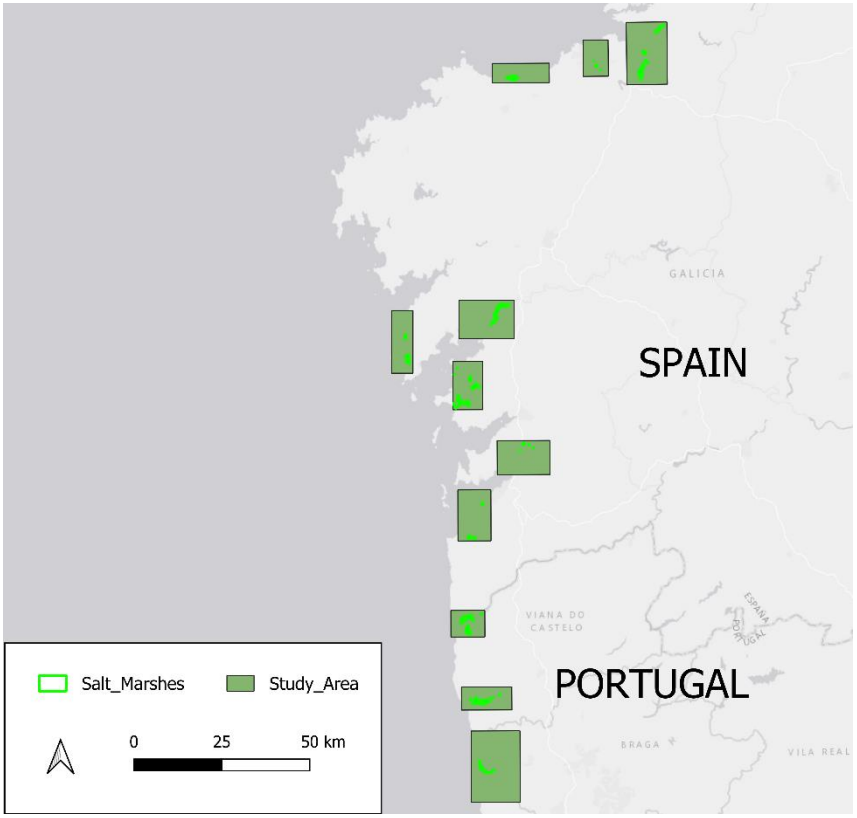

Image 1 – Study area with surveyed area in dark green and salt marsh areas in light green

2.2 Materials and Methods

The spatial delineation of salt marshes and adjacent areas was based on existing land-use and land-cover datasets from the Sistema de Información de Ocupación del Suelo de España (SIOSE-AR; available at : https://centrodedescargas.cnig.es), produced under the Plan Nacional de Observación del Territorio (PNOA), for Galicia, and from the Carta de Uso e Ocupação do Solo (COS ; available at : https://www.dgterritorio.gov.pt), produced by the Direção-Geral do Território (DGT), for northern Portugal. These datasets were complemented with high-resolution multispectral (MS) satellite imagery.

Satellite data is provided by the WorldView satellite constellation (more information at : **https://vantor.com/product/worldview**), including WorldView 2, 3, and 4, as well as Legion. Multispectral data from these satellites has eight spectral bands (listed in Table 2), with 1.2 m GSD, and an additional panchromatic band with 0.3 m GSD. All data have a radiometric resolution of 11bits. Pan sharpening post-processing can be applied to achieve a GSD of 0.3 m for the multispectral data.

Table 2 – Spectral Resolution of WorldView Satellite images

Band Name	Legion (nm)	World-View (nm)
Coastal	400–450	400–450
Blue	450–510	450–510
Green	510–580	510–580
Yellow	585–625	585–625
Red	630–690	630–690
Red Edge 1	695–715	705–745
Red Edge 2	730–750	
Near IR 1	770–895	770–895
Near IR 2		860–1040

The timing of satellite image acquisition was planned to optimise the visibility of intertidal and nearshore vegetation during spring low tides. Acquisition dates were selected based on two criteria: (i) the occurrence of a spring low tide, using the predicted tide at Vigo— approximately midway between the two extremes of the study region—as a reference, and (ii) Time difference between low tide and satellite overpass < 1h. This approach enhances the consistency and interpretability of the satellite data for biomass and habitat analyses.

Based on existing land-cover data from COS and SIOSE-AR, a visual interpretation of the satellite imagery was conducted to identify salt marsh areas. In cases where WorldView satellite data were insufficient for reliable salt marsh identification, very high-resolution imagery from Google Earth was used as supplementary supporting information. The resulting maps, presenting salt marsh cover for each area, are displayed from south to north, in Images 2 to 12. The colour differences visible in the border opf most images, show the difference between the (central, lighter) WorldView satellite images and the Google Earth images.

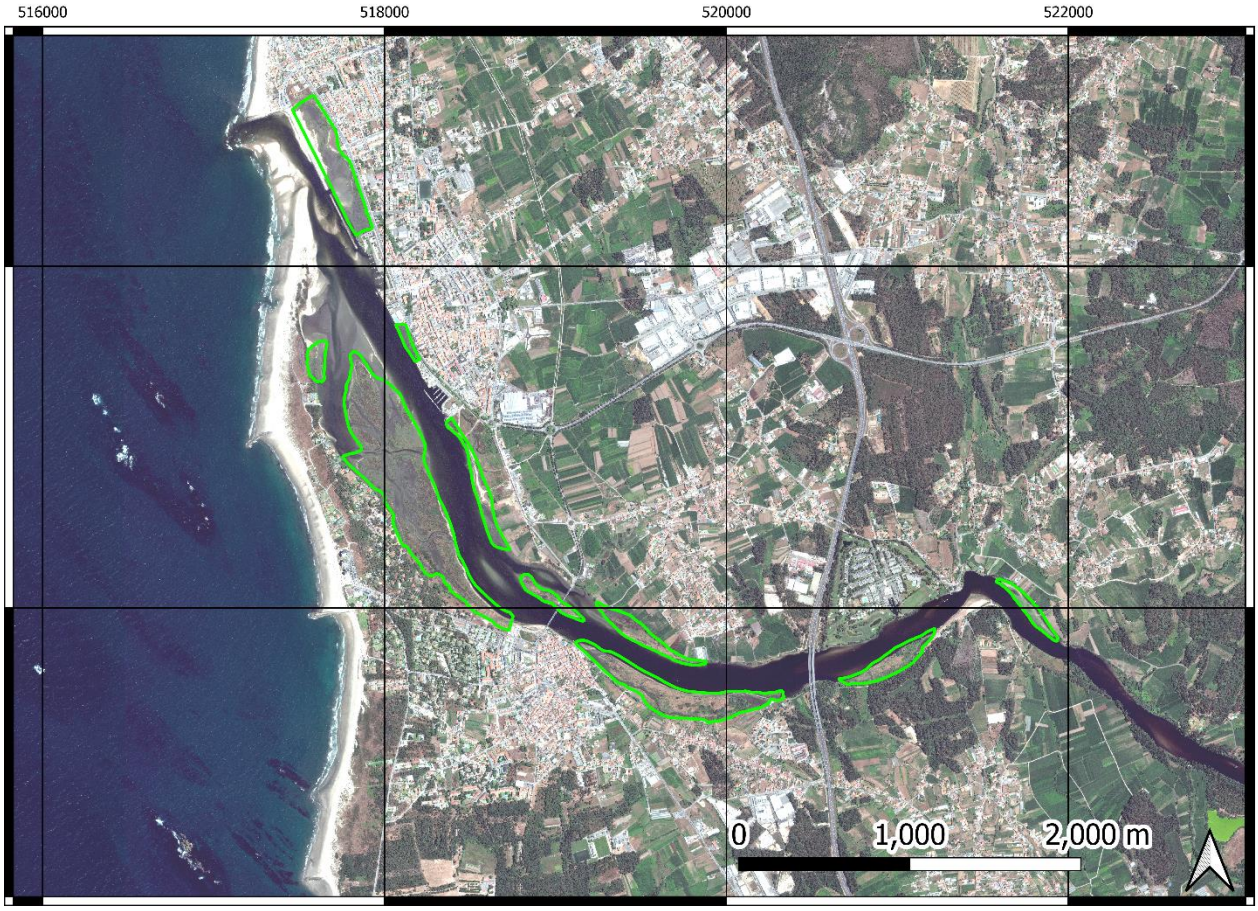

Image 2 – Cavado saltmarsh area (delimited in green)

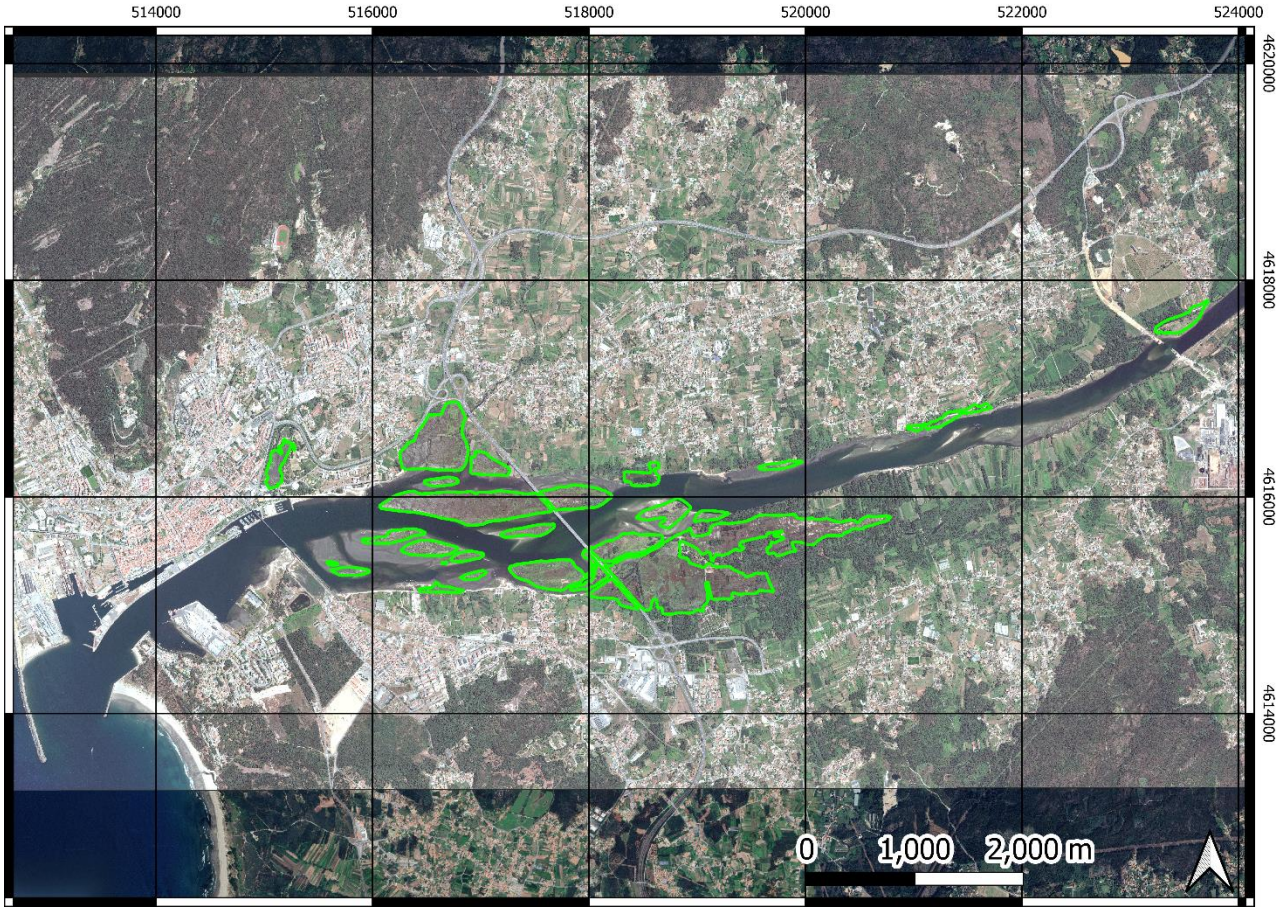

Image 3 – Lima saltmarsh area (delimited in green)

Image 4 – Minho saltmarsh area (delimited in green)

Image 5 – Ramallosa saltmarsh area (delimited in green)

Image 6 – Vigo saltmarsh area (delimited in green)

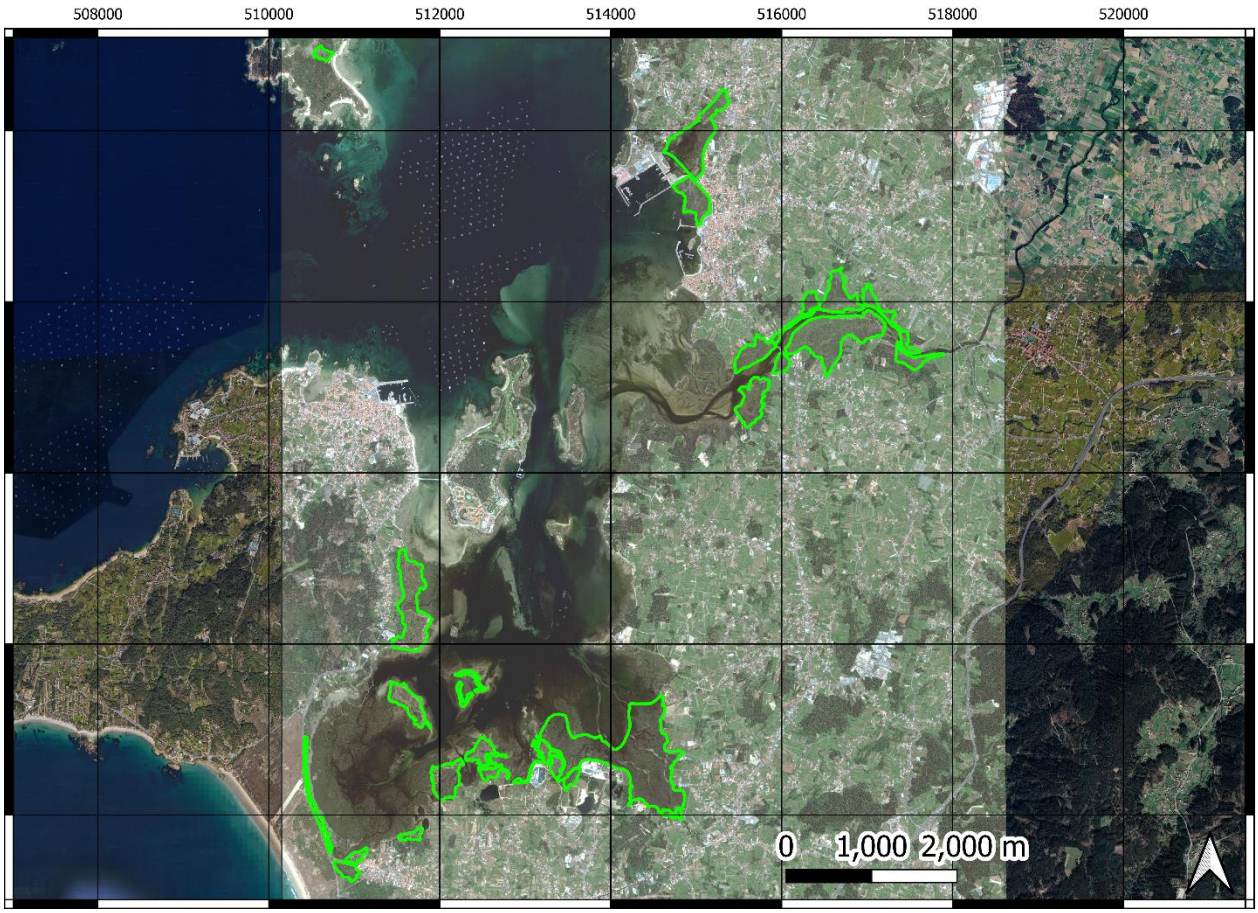

Image 7 – Umia saltmarsh area (delimited in green)

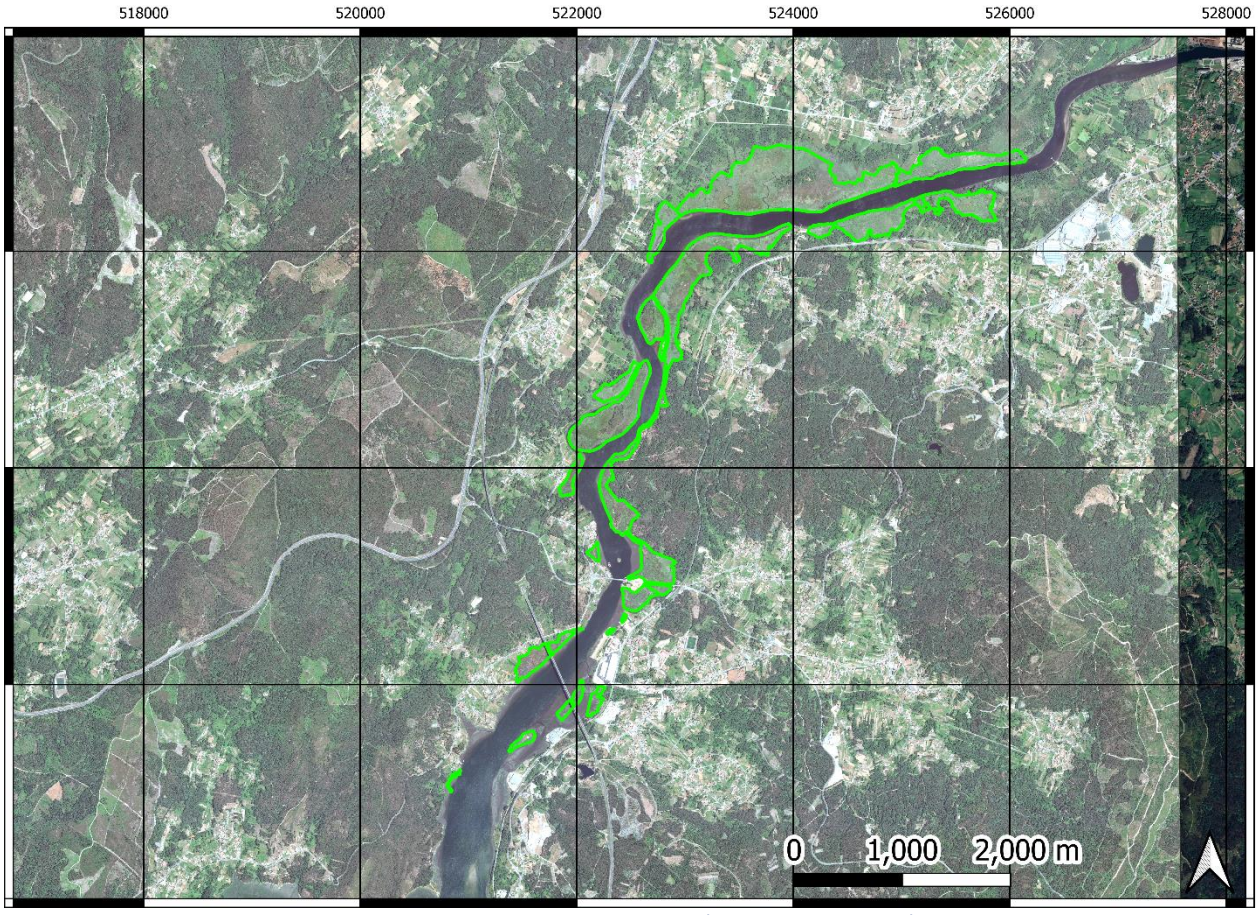

Image 8 – Ulla saltmarsh area (delimited in green)

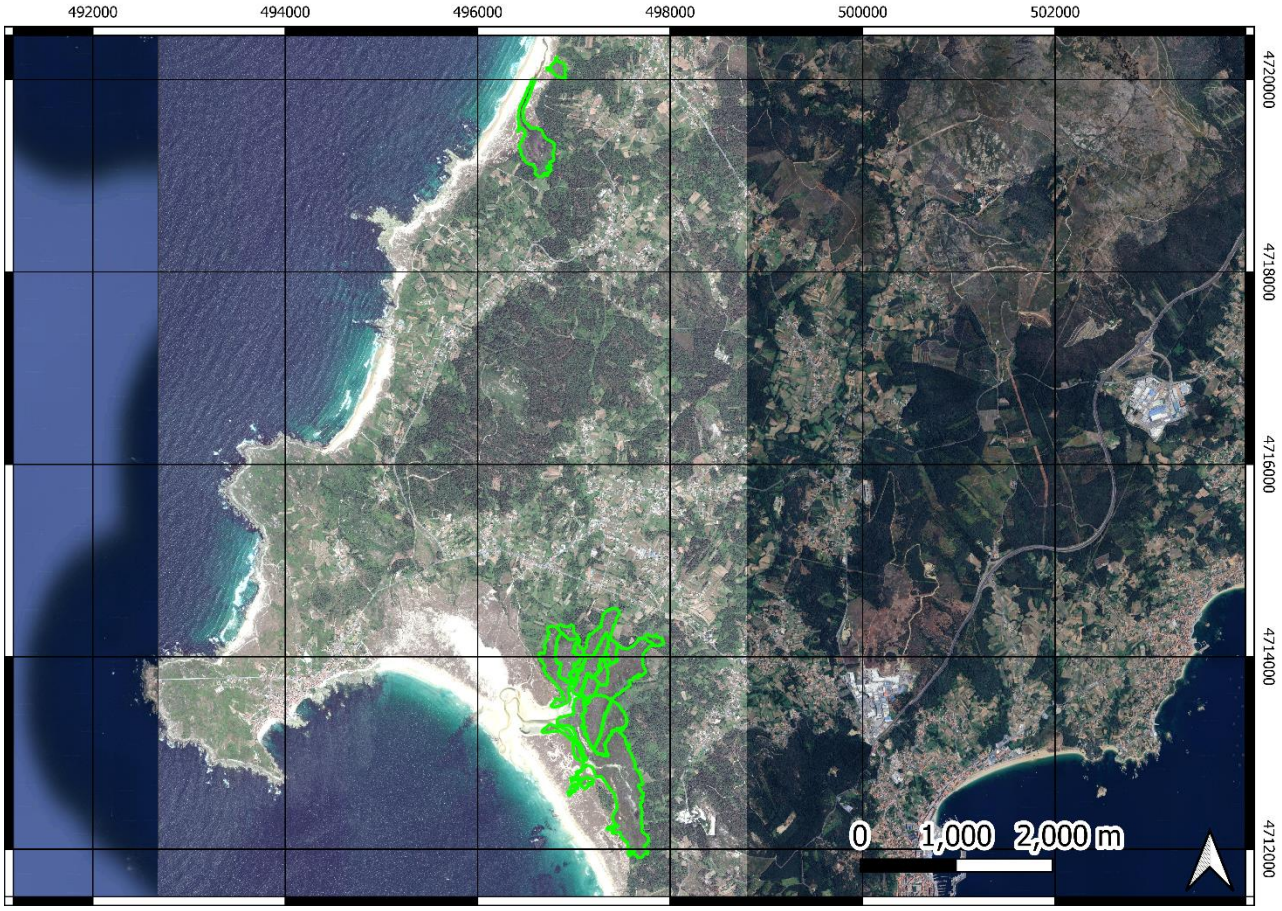

Image 9 – Carregal saltmarsh area (delimited in green)

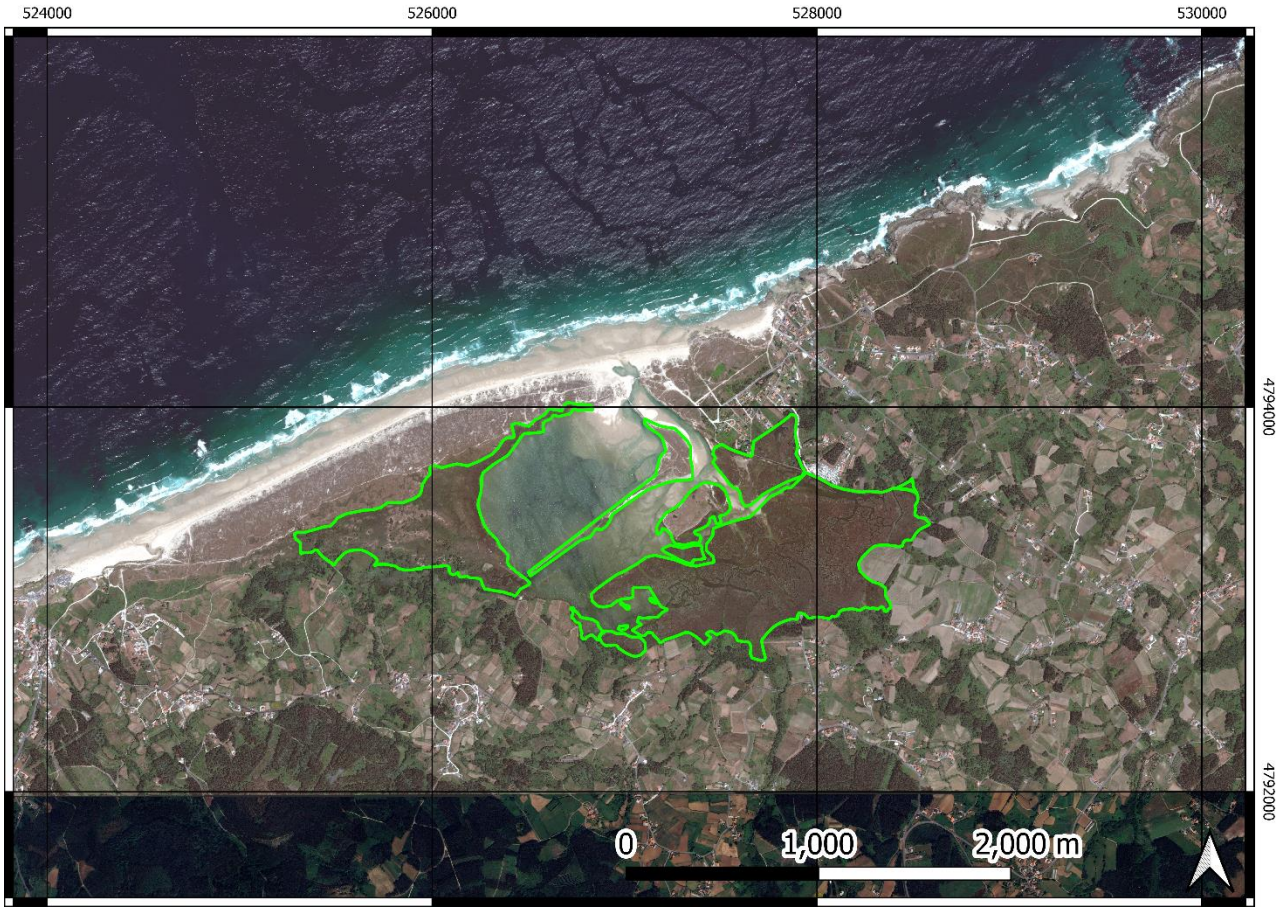

Image 10 – Baldaio saltmarsh area (delimited in green)

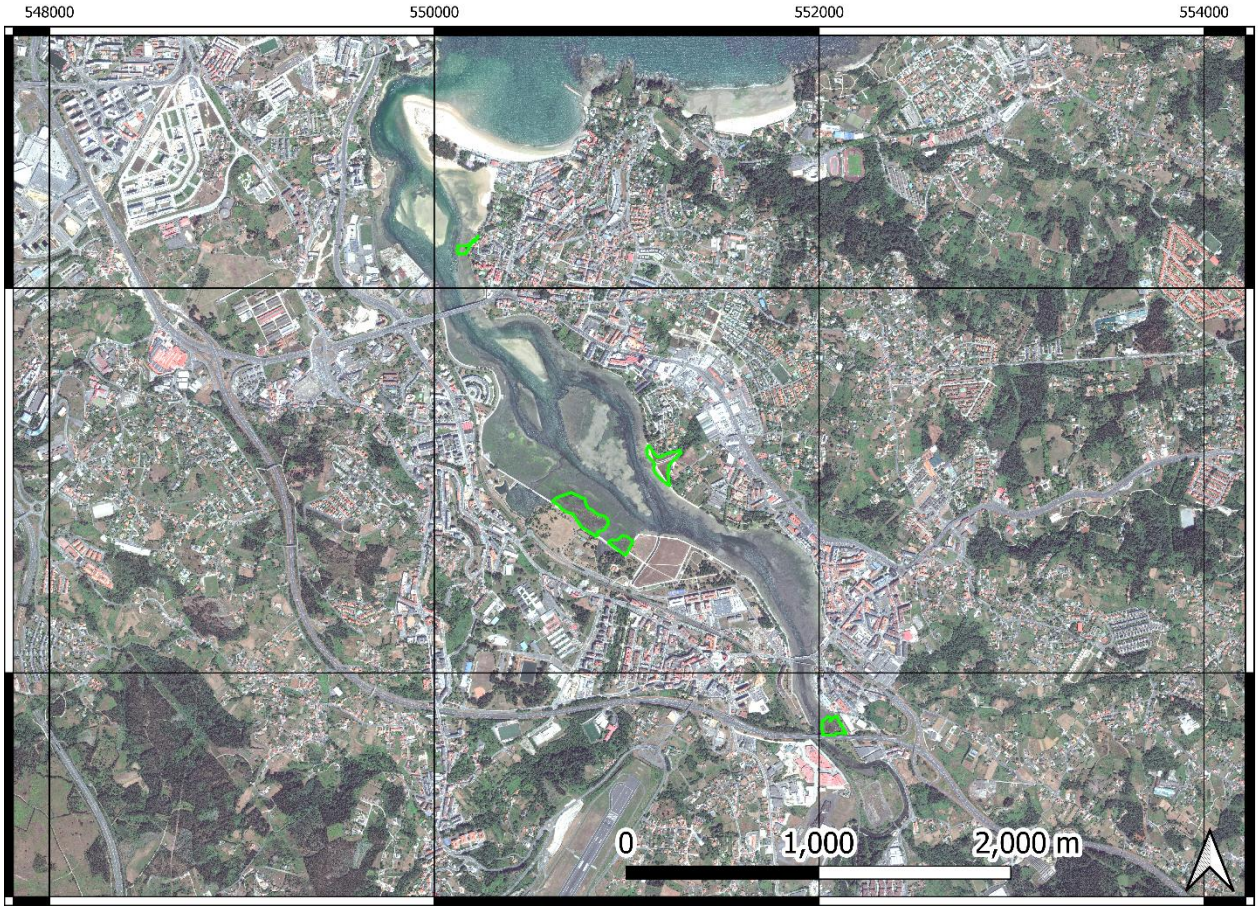

Image 11 – Coruña saltmarsh area (delimited in green)

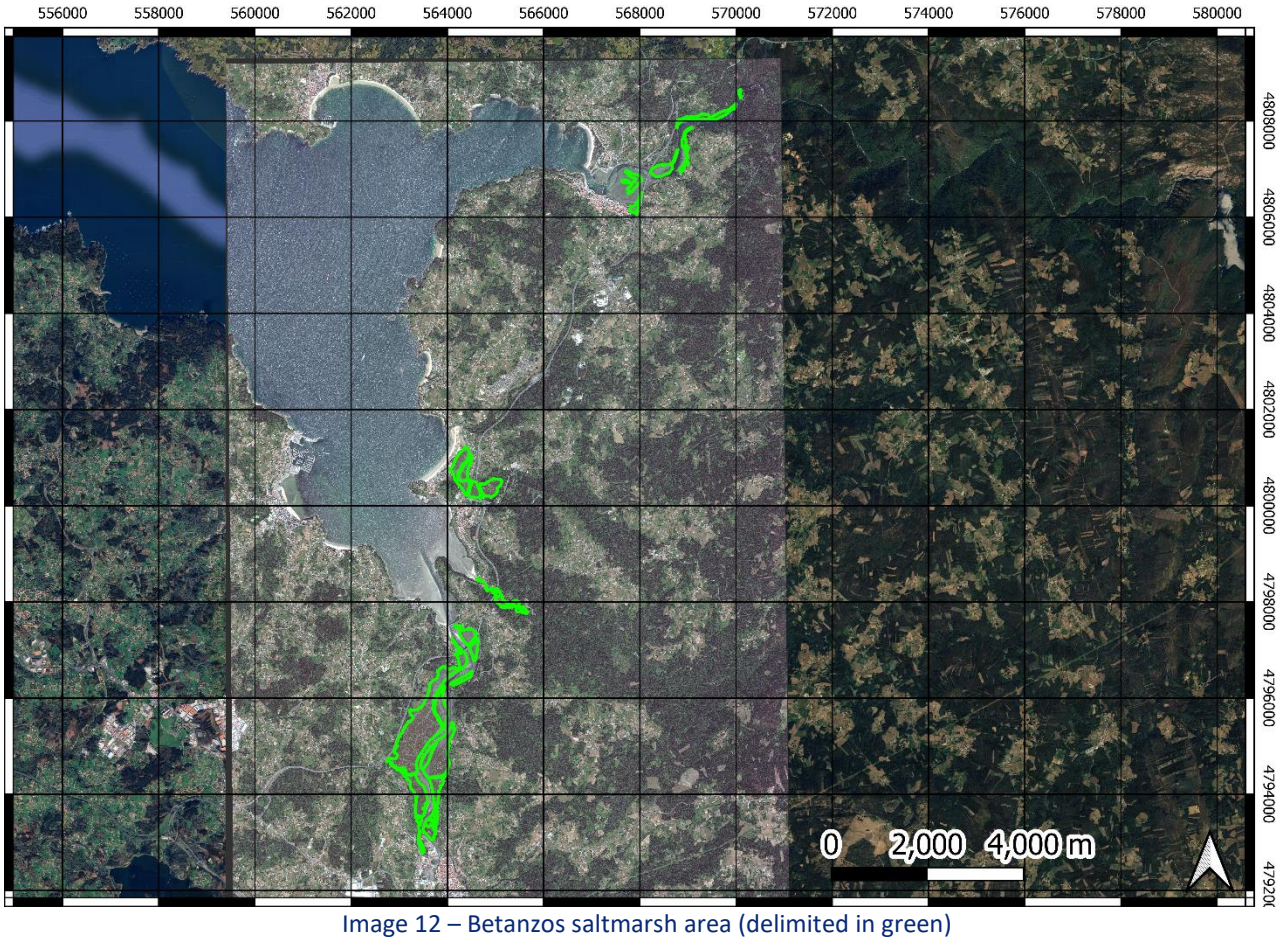

Image 12 – Betanzos saltmarsh area (delimited in green)

3. Conclusions

Salt marsh distribution maps were obtained by combining land-cover information with up-to-date remote-sensing data and careful visual interpretation. This methodology provides a reliable spatial delineation of salt marshes in the WorldView satellite imagery of northern Portugal and Galicia, acquired by the CAPTA project, enabling further lines of investigation, including species identification and biomass estimation using computational techniques. Results suggest that high-resolution satellite imagery can be used for saltmarsh monitoring, which is essential for understanding the spatial distribution of this ecosystem and identifying areas most vulnerable to external pressures.

4. Data availability

The vector datasets of salt marsh areas produced in this study and the acquired satellite imagery will be made available for online visualisation through the project's web platform. An interactive interface at http://marnaraia.org/pt/home-portugues/ will allow users to explore the spatial extent of the mapped salt marshes alongside the high-resolution satellite imagery. This platform is intended to support data dissemination, transparency, and stakeholder engagement, enabling researchers, environmental managers, and decision-makers to access and visually inspect the results.

References

Alongi, D. M. (2020). Carbon Balance in Salt Marsh and Mangrove Ecosystems: A Global Synthesis. *Journal of Marine Science and Engineering*, *8*(10), 767. https://doi.org/10.3390/jmse8100767

Chastain, S. G., Kohfeld, K. E., Pellatt, M. G., Olid, C., & Gailis, M. (2022). Quantification of blue carbon in salt marshes of the Pacific coast of Canada. *Biogeosciences*, *19*(24), 5751–5777. https://doi.org/10.5194/bg-19-5751-2022

Macreadie, P. I., Hughes, A. R., & Kimbro, D. L. (2013). Loss of 'Blue Carbon' from Coastal Salt Marshes Following Habitat Disturbance. *PLoS ONE*, *8*(7), e69244. https://doi.org/10.1371/journal.pone.0069244

Perez-Arlucea, M., Mendez, G., Clemente, F., Nombela, M., Rubio, B., & Filgueira, M. (2005). Hydrology, sediment yield, erosion and sedimentation rates in the estuarine environment of the Ria de Vigo, Galicia, Spain. *Journal of Marine Systems*, *54*(1–4), 209–226. https://doi.org/10.1016/j.jmarsys.2004.07.013

Pham, T. D., Xia, J., Ha, N. T., Bui, D. T., Le, N. N., & Tekeuchi, W. (2019). A Review of Remote Sensing Approaches for Monitoring Blue Carbon Ecosystems: Mangroves, Seagrassesand Salt Marshes during 2010–2018. *Sensors*, *19*(8), 1933. https://doi.org/10.3390/s19081933

Radabaugh, K. R., Moyer, R. P., Chappel, A. R., Powell, C. E., Bociu, I., Clark, B. C., & Smoak, J. M. (2018). Coastal Blue Carbon Assessment of Mangroves, Salt Marshes, and Salt Barrens in Tampa Bay, Florida, USA. *Estuaries and Coasts*, *41*(5), 1496–1510. https://doi.org/10.1007/s12237-017-0362-7