



Carbono Azul



BLUE TALKS

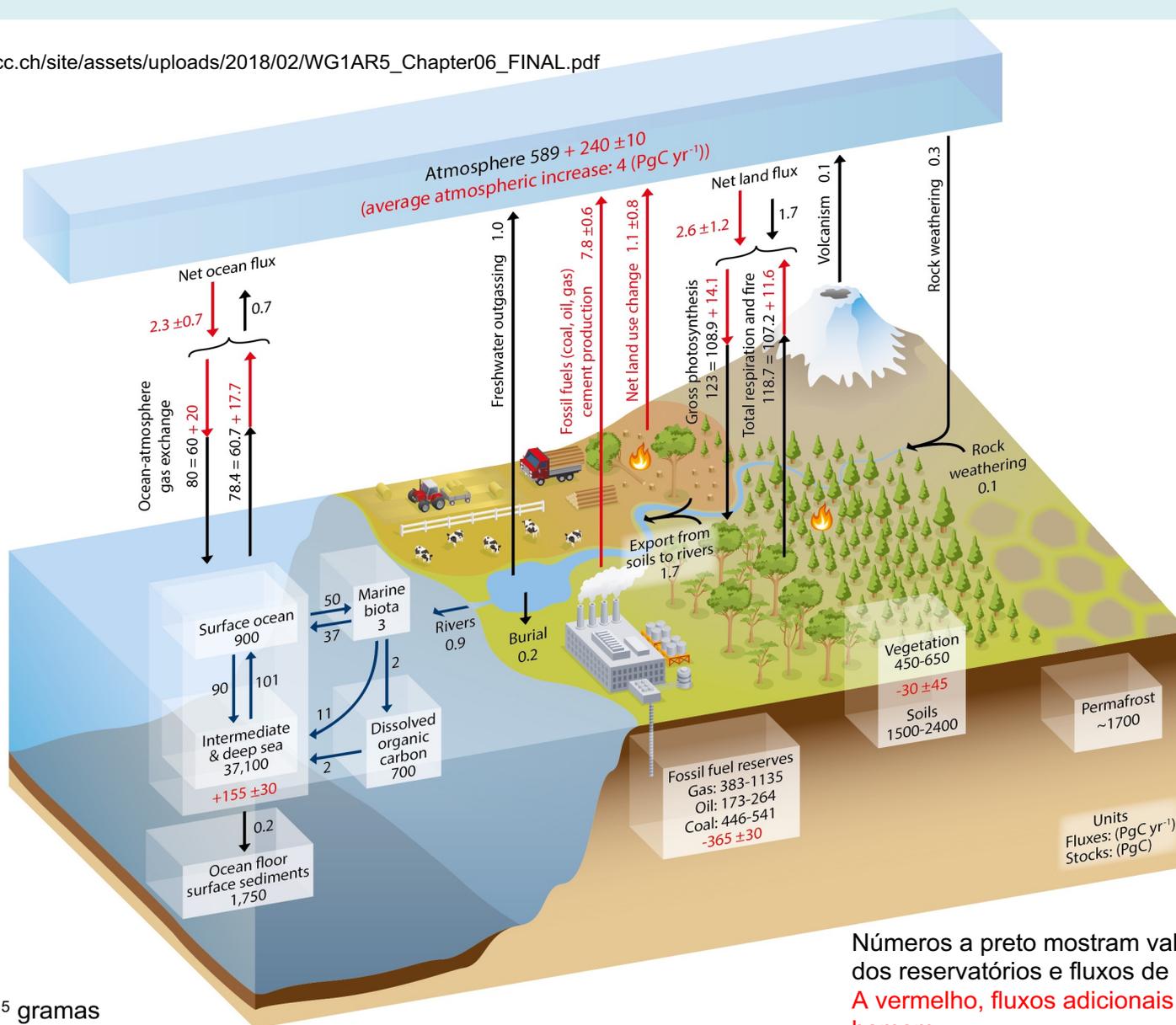
Bridges to Lisbon:
The 2022 United Nations
Ocean Conference

La Habana | 26 de mayo de 2022, 9:00 am (Cuba), 2:00 pm (Lisboa)

Blue Talk Havana

Ciclo global do carbono - IPCC 2018

https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter06_FINAL.pdf



1 Pg = 1x10¹⁵ gramas

Números a preto mostram valores pré-industriais dos reservatórios e fluxos de carbono
A vermelho, fluxos adicionais causados pelo homem

Ecossistemas de C azul: Mangais



Ecosistemas de C azul: Sapais



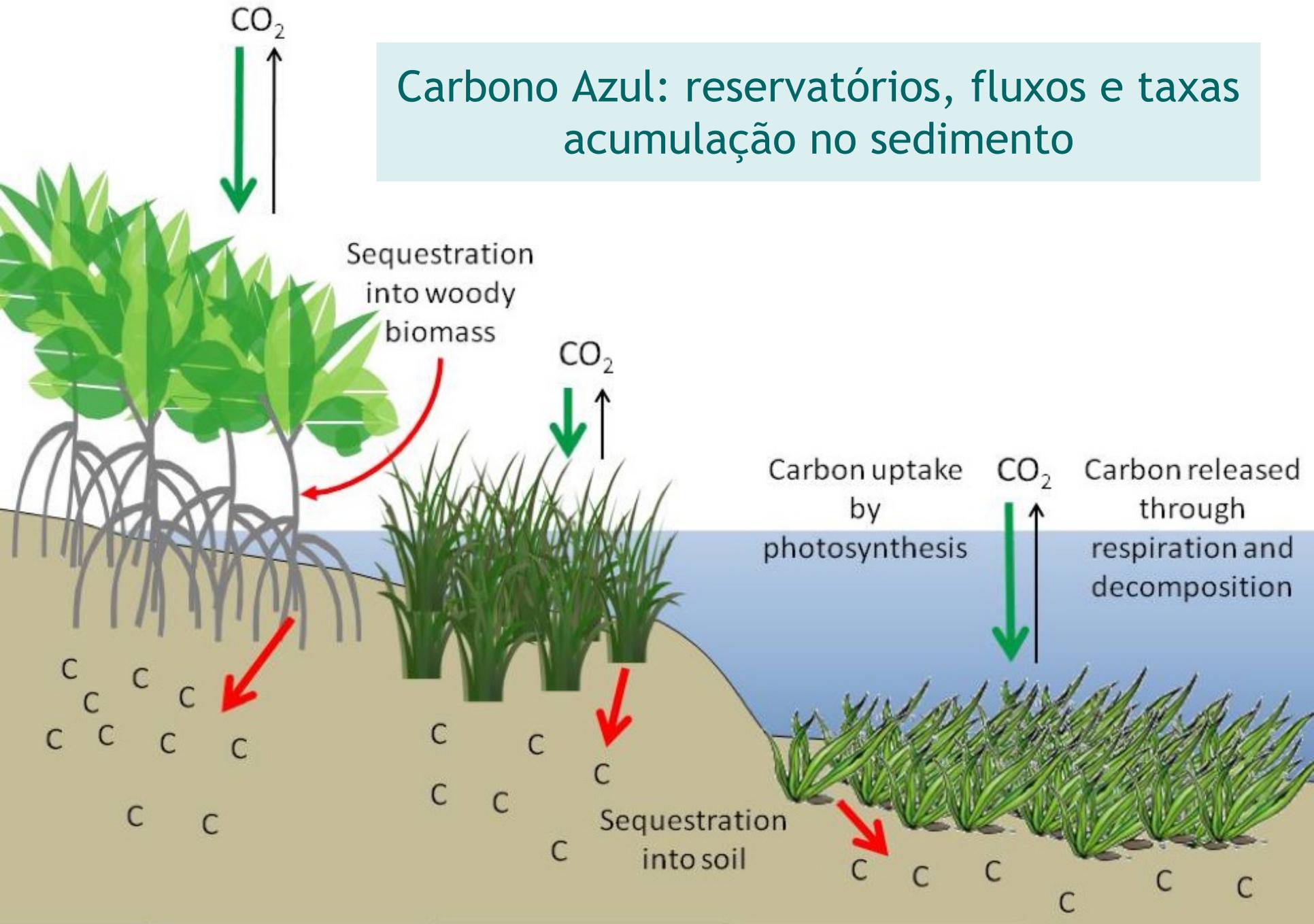
Ecossistemas de C azul: Ervas marinhas



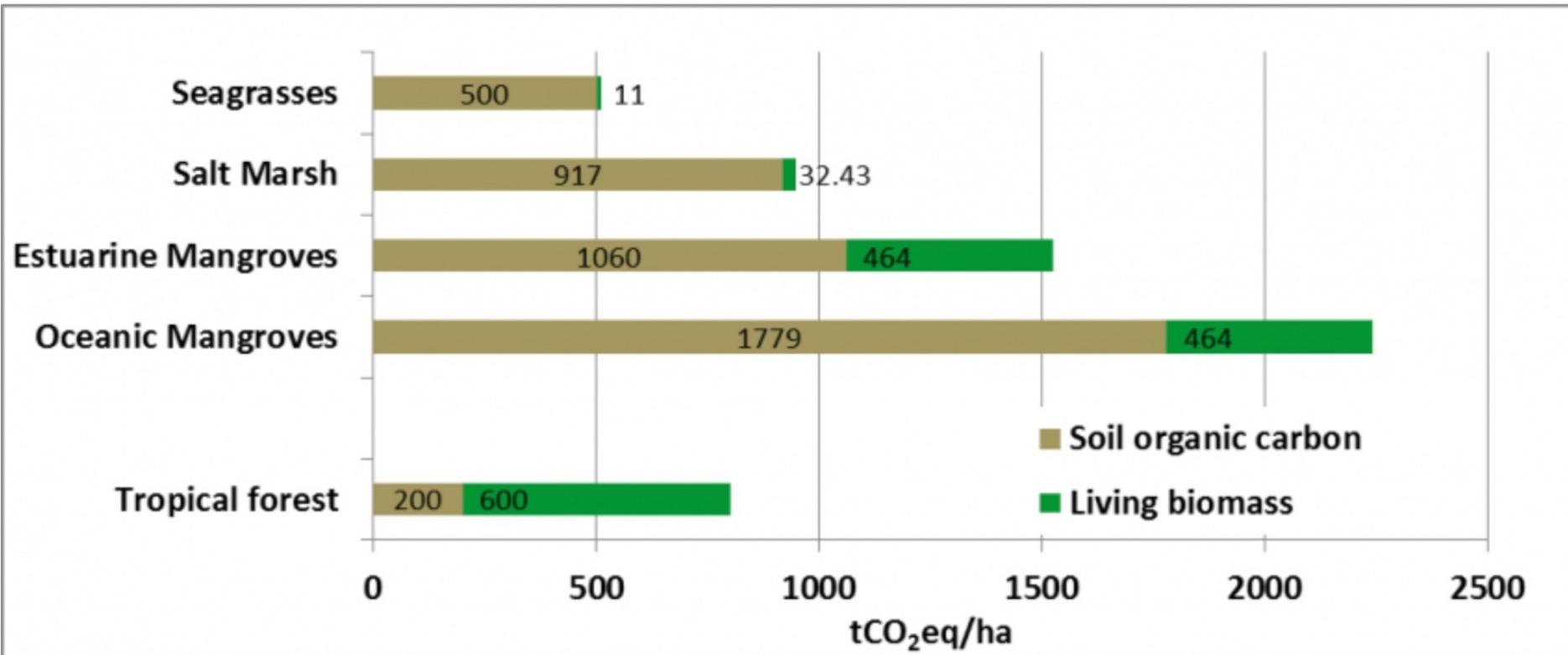
Carbono Azul - definição IPCC

- Carbono que é capturado e armazenado pelos ecossistemas costeiros e marinhos.
- Inclui todos os **reservatórios e fluxos** que são determinados biologicamente e que são suscetíveis de ser geridos.

Carbono Azul: reservatórios, fluxos e taxas acumulação no sedimento



Stocks de Carbono Azul (CO₂eq/ha)



<https://www.iucn.org/resources/issues-briefs/blue-carbon>

Taxa de acumulação de carbono azul

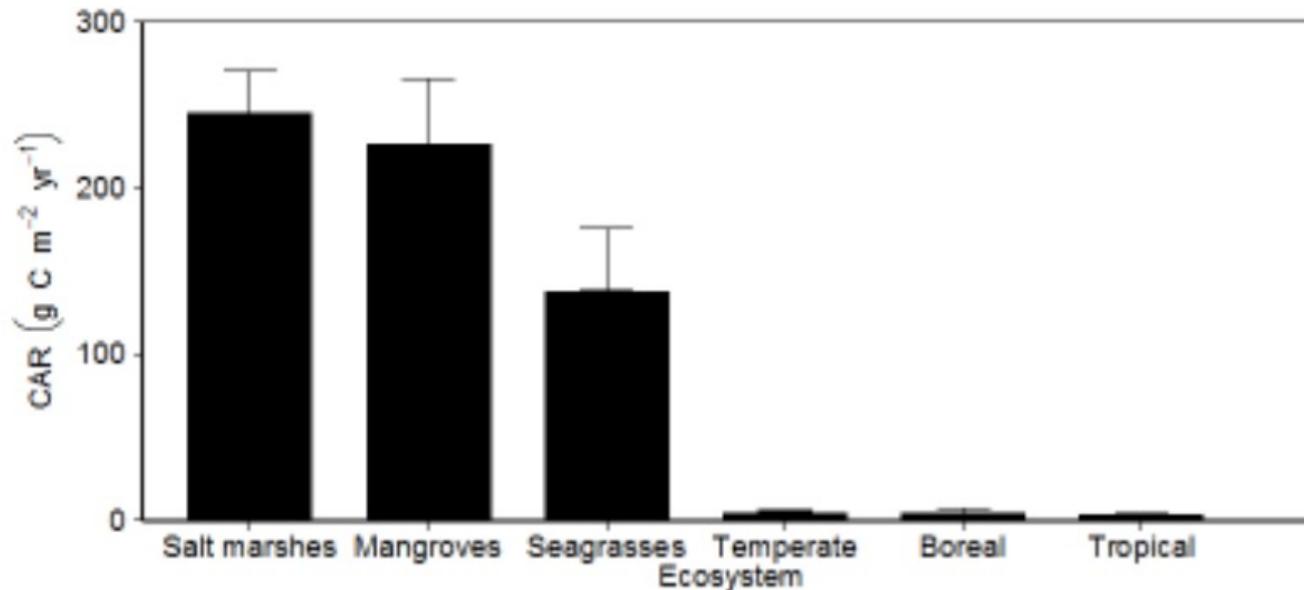
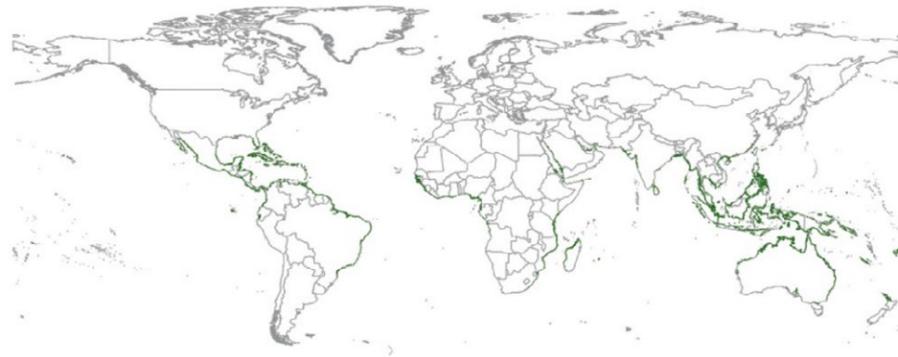


Figure 6. Average CAR (\pm SE) in sediments and soils of major coastal and terrestrial forest ecosystems.

Ouyang X and Lee SY, 2014. Updated estimates of carbon accumulation rates in coastal marsh sediments *Biogeosciences*, 11, 5057-5071, 2014, <https://doi.org/10.5194/bg-11-5057-2014>

DISTRIBUIÇÃO GLOBAL DOS ECAs

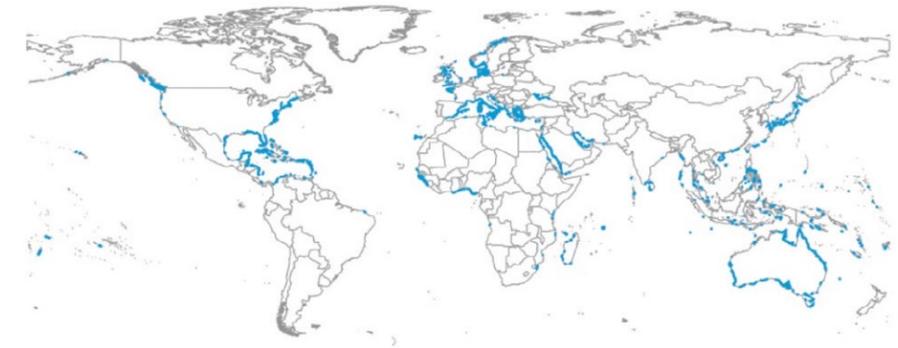
Mangrove forests



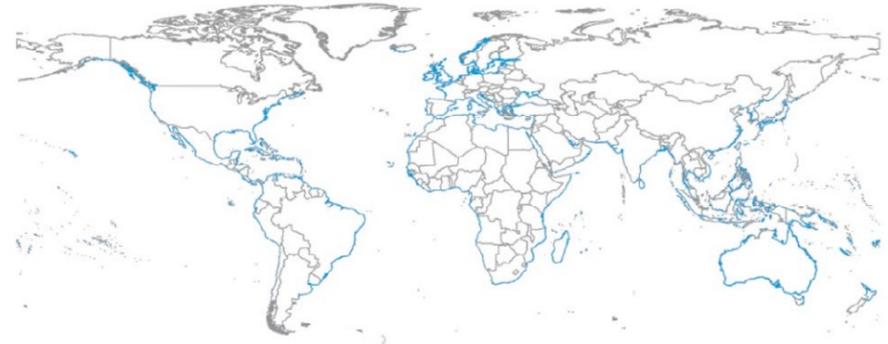
Tidal marshes



Seagrass meadows
Mapped distribution



Seagrass meadows
Modelled distribution



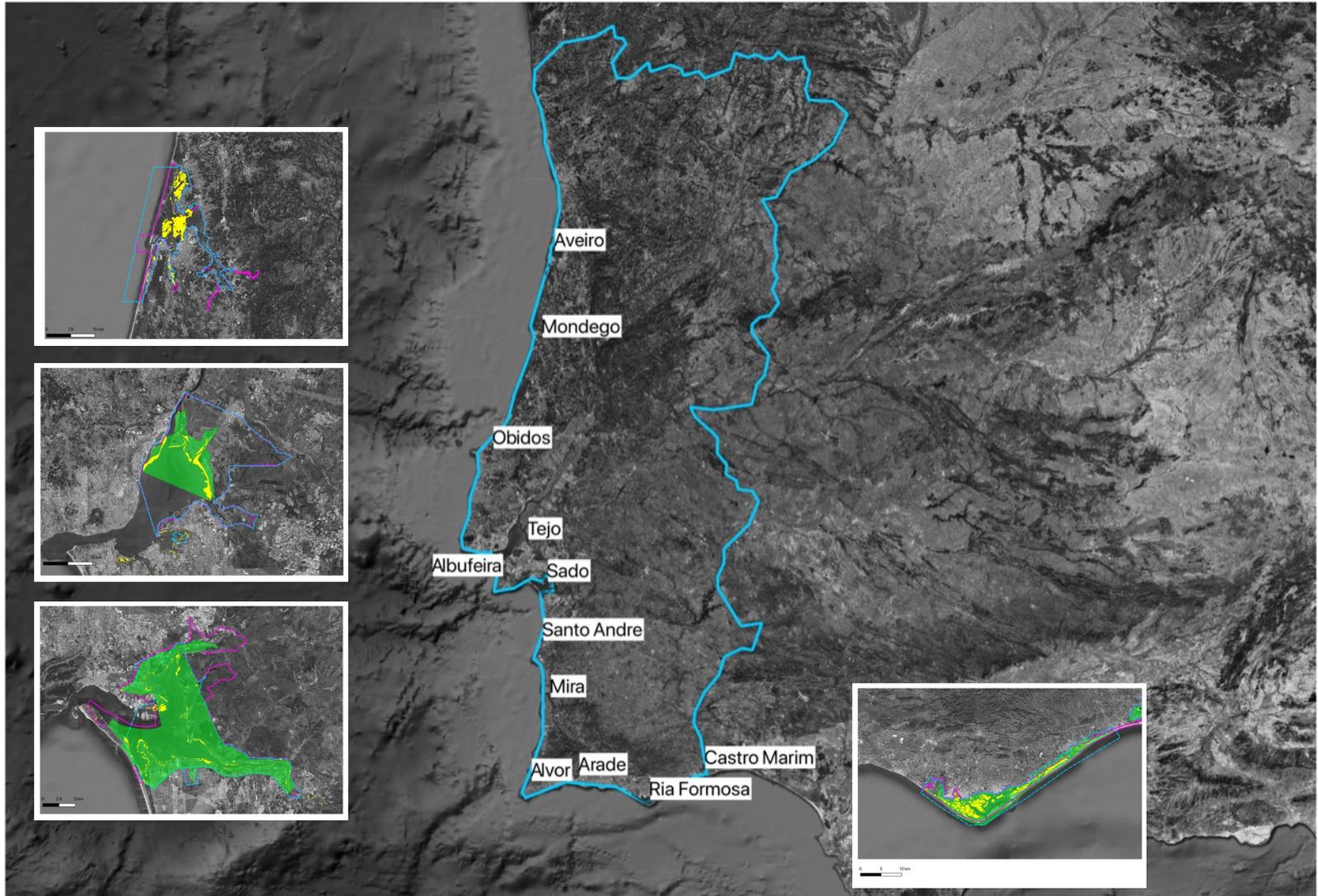
Distribuição global estimada: 36–185 million ha

Nas últimas décadas, perderam-se cerca de 50% dos ECAs!

ECAs para a mitigação das alterações climáticas

- Os ECAs são os mais eficientes a sequestrar carbono orgânico
- Ocupam apenas 0,5% da área do oceano mas contribuem com mais de 50% do carbono sequestrado nos sedimentos do oceano.
- Globalmente, os ECAs armazenam cerca de 30 Pg de C
- Se a taxa de declínio dos ECAs for reduzida a zero, evitam-se emissões de cerca de 0,1 Pg de C por ano (Macreadie et al., 2021)
- Os ECAs que foram perdidos ou estão degradados devem ser restaurados
- O restauro potencial global dos ECAs pode remover cerca de 0,23 Pg C por ano, i.e. cerca de 3% das emissões globais anuais de carbono (Macreadie et al., 2021)

ECAs em Portugal



RNC2050

Roteiro para a Neutralidade Carbónica 2050

Resolução do Conselho de Ministros n.º 107/2019

Atingir a neutralidade carbónica em 2050 implica, a par do **reforço da capacidade de sequestro de carbono pelas florestas** e por outros usos do solo, a quase total descarbonização sobretudo do sistema electroprodutor e da mobilidade urbana.

Não existe nenhuma referência aos ECAs

Lei de Bases do Clima

Lei n.º 98/2021 de 31 de Dezembro de 2021

Pela primeira vez os ecossistemas de carbono azul são considerados nas metas nacionais de mitigação (nº 4 do artº 19) e nas estratégias nacionais de sequestro de carbono (artº 58).

Artigo 58.º Oceano e reservatórios de carbono

d) Avaliação de necessidades e consequente implementação de ações de restauro ecológico e desenvolvimento sustentável de ecossistemas costeiros e marinhos, incluindo sapais, pradarias de ervas marinhas, recifes e florestas de algas;

Artigo 19.º Metas nacionais de mitigação

4 — São estimadas e adotadas metas para o sumidouro de CO2 equivalente dos ecossistemas costeiros e marinhos, incluindo sapais, pradarias de ervas marinhas, recifes e florestas de algas, visando a antecipação da meta da neutralidade climática

VEGETATION

Biomass analysis



Tissue C analysis



Literature review

Year	Author	Title	Journal	Volume	Page
2018	Smith et al.	Carbon sequestration in wetlands	Wetlands	38	123-135
2017	Johnson et al.	Vegetation dynamics in coastal marshes	Estuaries and Coasts	40	45-58
2016	Lee et al.	Impact of sea level rise on plant communities	Global Change Biology	22	2100-2115
2015	White et al.	Soil carbon storage in different vegetation types	Soil Science Society of America Journal	79	1500-1515
2014	Black et al.	Remote sensing of vegetation indices	Remote Sensing of the Environment	140	420-435
2013	Green et al.	Fieldwork studies in coastal ecosystems	Journal of Field Research	15	10-25
2012	Blue et al.	Mapping wetland areas using aerial imagery	International Journal of Remote Sensing	33	1800-1815
2011	Red et al.	Drivers and impacts of land use change	Land Use Policy	28	300-315
2010	Purple et al.	Soil cores and their analysis	Soil Science Society of America Journal	74	1200-1215
2009	Orange et al.	Vegetation biomass estimation	Ecology	90	1500-1515
2008	Yellow et al.	Mapping wetland areas	Wetlands	28	100-115
2007	Black et al.	Fieldwork studies	Journal of Field Research	13	5-20
2006	Green et al.	Soil carbon analysis	Soil Science Society of America Journal	70	1800-1815
2005	Blue et al.	Vegetation mapping	Remote Sensing of the Environment	97	250-265
2004	Red et al.	Drivers and impacts	Land Use Policy	21	150-165
2003	Purple et al.	Soil cores	Soil Science Society of America Journal	67	1200-1215
2002	Orange et al.	Vegetation biomass	Ecology	83	1500-1515
2001	Yellow et al.	Mapping wetlands	Wetlands	21	100-115
2000	Black et al.	Fieldwork studies	Journal of Field Research	11	5-20
1999	Green et al.	Soil carbon	Soil Science Society of America Journal	63	1800-1815
1998	Blue et al.	Vegetation	Remote Sensing of the Environment	65	250-265
1997	Red et al.	Drivers and impacts	Land Use Policy	14	150-165
1996	Purple et al.	Soil cores	Soil Science Society of America Journal	60	1200-1215
1995	Orange et al.	Vegetation biomass	Ecology	76	1500-1515
1994	Yellow et al.	Mapping wetlands	Wetlands	14	100-115
1993	Black et al.	Fieldwork studies	Journal of Field Research	9	5-20
1992	Green et al.	Soil carbon	Soil Science Society of America Journal	56	1800-1815
1991	Blue et al.	Vegetation	Remote Sensing of the Environment	58	250-265
1990	Red et al.	Drivers and impacts	Land Use Policy	7	150-165
1989	Purple et al.	Soil cores	Soil Science Society of America Journal	53	1200-1215
1988	Orange et al.	Vegetation biomass	Ecology	69	1500-1515
1987	Yellow et al.	Mapping wetlands	Wetlands	7	100-115
1986	Black et al.	Fieldwork studies	Journal of Field Research	6	5-20
1985	Green et al.	Soil carbon	Soil Science Society of America Journal	49	1800-1815
1984	Blue et al.	Vegetation	Remote Sensing of the Environment	51	250-265
1983	Red et al.	Drivers and impacts	Land Use Policy	4	150-165
1982	Purple et al.	Soil cores	Soil Science Society of America Journal	46	1200-1215
1981	Orange et al.	Vegetation biomass	Ecology	62	1500-1515
1980	Yellow et al.	Mapping wetlands	Wetlands	6	100-115
1979	Black et al.	Fieldwork studies	Journal of Field Research	5	5-20
1978	Green et al.	Soil carbon	Soil Science Society of America Journal	42	1800-1815
1977	Blue et al.	Vegetation	Remote Sensing of the Environment	44	250-265
1976	Red et al.	Drivers and impacts	Land Use Policy	3	150-165
1975	Purple et al.	Soil cores	Soil Science Society of America Journal	39	1200-1215
1974	Orange et al.	Vegetation biomass	Ecology	55	1500-1515
1973	Yellow et al.	Mapping wetlands	Wetlands	3	100-115
1972	Black et al.	Fieldwork studies	Journal of Field Research	2	5-20
1971	Green et al.	Soil carbon	Soil Science Society of America Journal	35	1800-1815
1970	Blue et al.	Vegetation	Remote Sensing of the Environment	37	250-265
1969	Red et al.	Drivers and impacts	Land Use Policy	2	150-165
1968	Purple et al.	Soil cores	Soil Science Society of America Journal	32	1200-1215
1967	Orange et al.	Vegetation biomass	Ecology	48	1500-1515
1966	Yellow et al.	Mapping wetlands	Wetlands	2	100-115
1965	Black et al.	Fieldwork studies	Journal of Field Research	1	5-20
1964	Green et al.	Soil carbon	Soil Science Society of America Journal	28	1800-1815
1963	Blue et al.	Vegetation	Remote Sensing of the Environment	30	250-265
1962	Red et al.	Drivers and impacts	Land Use Policy	1	150-165
1961	Purple et al.	Soil cores	Soil Science Society of America Journal	25	1200-1215
1960	Orange et al.	Vegetation biomass	Ecology	41	1500-1515
1959	Yellow et al.	Mapping wetlands	Wetlands	1	100-115
1958	Black et al.	Fieldwork studies	Journal of Field Research	0	5-20
1957	Green et al.	Soil carbon	Soil Science Society of America Journal	21	1800-1815
1956	Blue et al.	Vegetation	Remote Sensing of the Environment	23	250-265
1955	Red et al.	Drivers and impacts	Land Use Policy	0	150-165
1954	Purple et al.	Soil cores	Soil Science Society of America Journal	18	1200-1215
1953	Orange et al.	Vegetation biomass	Ecology	34	1500-1515
1952	Yellow et al.	Mapping wetlands	Wetlands	0	100-115
1951	Black et al.	Fieldwork studies	Journal of Field Research	0	5-20
1950	Green et al.	Soil carbon	Soil Science Society of America Journal	14	1800-1815
1949	Blue et al.	Vegetation	Remote Sensing of the Environment	16	250-265
1948	Red et al.	Drivers and impacts	Land Use Policy	0	150-165
1947	Purple et al.	Soil cores	Soil Science Society of America Journal	11	1200-1215
1946	Orange et al.	Vegetation biomass	Ecology	27	1500-1515
1945	Yellow et al.	Mapping wetlands	Wetlands	0	100-115
1944	Black et al.	Fieldwork studies	Journal of Field Research	0	5-20
1943	Green et al.	Soil carbon	Soil Science Society of America Journal	13	1800-1815
1942	Blue et al.	Vegetation	Remote Sensing of the Environment	15	250-265
1941	Red et al.	Drivers and impacts	Land Use Policy	0	150-165
1940	Purple et al.	Soil cores	Soil Science Society of America Journal	10	1200-1215
1939	Orange et al.	Vegetation biomass	Ecology	26	1500-1515
1938	Yellow et al.	Mapping wetlands	Wetlands	0	100-115
1937	Black et al.	Fieldwork studies	Journal of Field Research	0	5-20
1936	Green et al.	Soil carbon	Soil Science Society of America Journal	12	1800-1815
1935	Blue et al.	Vegetation	Remote Sensing of the Environment	14	250-265
1934	Red et al.	Drivers and impacts	Land Use Policy	0	150-165
1933	Purple et al.	Soil cores	Soil Science Society of America Journal	9	1200-1215
1932	Orange et al.	Vegetation biomass	Ecology	25	1500-1515
1931	Yellow et al.	Mapping wetlands	Wetlands	0	100-115
1930	Black et al.	Fieldwork studies	Journal of Field Research	0	5-20
1929	Green et al.	Soil carbon	Soil Science Society of America Journal	11	1800-1815
1928	Blue et al.	Vegetation	Remote Sensing of the Environment	13	250-265
1927	Red et al.	Drivers and impacts	Land Use Policy	0	150-165
1926	Purple et al.	Soil cores	Soil Science Society of America Journal	8	1200-1215
1925	Orange et al.	Vegetation biomass	Ecology	24	1500-1515
1924	Yellow et al.	Mapping wetlands	Wetlands	0	100-115
1923	Black et al.	Fieldwork studies	Journal of Field Research	0	5-20
1922	Green et al.	Soil carbon	Soil Science Society of America Journal	10	1800-1815
1921	Blue et al.	Vegetation	Remote Sensing of the Environment	12	250-265
1920	Red et al.	Drivers and impacts	Land Use Policy	0	150-165
1919	Purple et al.	Soil cores	Soil Science Society of America Journal	7	1200-1215
1918	Orange et al.	Vegetation biomass	Ecology	23	1500-1515
1917	Yellow et al.	Mapping wetlands	Wetlands	0	100-115
1916	Black et al.	Fieldwork studies	Journal of Field Research	0	5-20
1915	Green et al.	Soil carbon	Soil Science Society of America Journal	9	1800-1815
1914	Blue et al.	Vegetation	Remote Sensing of the Environment	11	250-265
1913	Red et al.	Drivers and impacts	Land Use Policy	0	150-165
1912	Purple et al.	Soil cores	Soil Science Society of America Journal	6	1200-1215
1911	Orange et al.	Vegetation biomass	Ecology	22	1500-1515
1910	Yellow et al.	Mapping wetlands	Wetlands	0	100-115
1909	Black et al.	Fieldwork studies	Journal of Field Research	0	5-20
1908	Green et al.	Soil carbon	Soil Science Society of America Journal	8	1800-1815
1907	Blue et al.	Vegetation	Remote Sensing of the Environment	10	250-265
1906	Red et al.	Drivers and impacts	Land Use Policy	0	150-165
1905	Purple et al.	Soil cores	Soil Science Society of America Journal	5	1200-1215
1904	Orange et al.	Vegetation biomass	Ecology	20	1500-1515
1903	Yellow et al.	Mapping wetlands	Wetlands	0	100-115
1902	Black et al.	Fieldwork studies	Journal of Field Research	0	5-20
1901	Green et al.	Soil carbon	Soil Science Society of America Journal	7	1800-1815
1900	Blue et al.	Vegetation	Remote Sensing of the Environment	9	250-265

SOIL

Cores (deep)



Cores (sup)

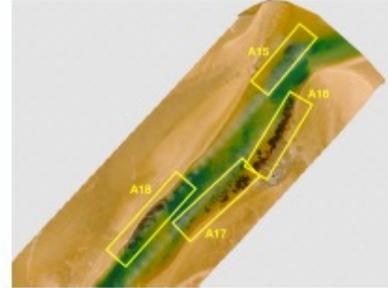


Sed analysis



MAPPING

Aerial images



Video transects



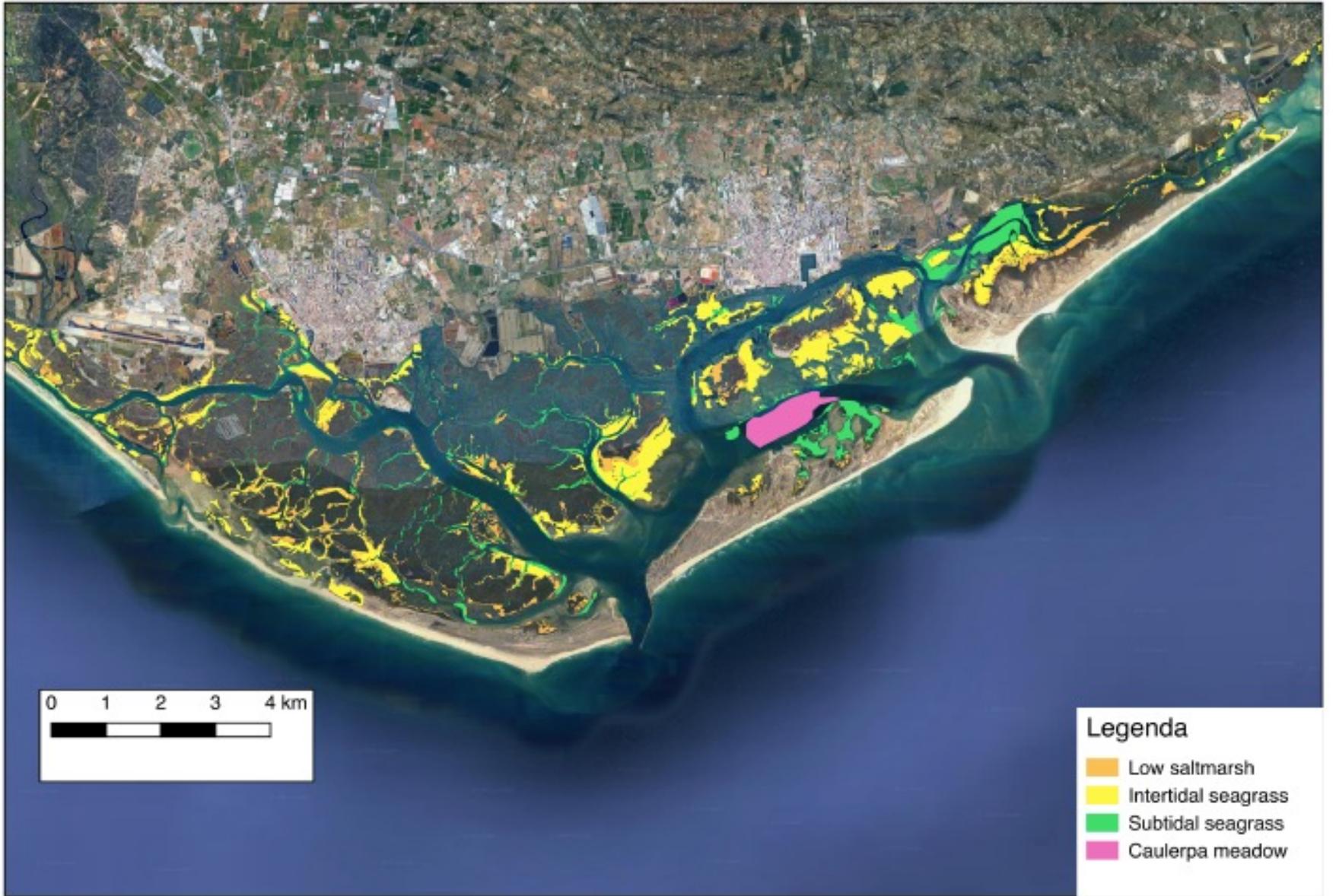
GPS data points



DRIVERS & IMPACTS

Fieldwork studies





Carbono Azul na Ria Formosa

(dados preliminares)

Ria Formosa	Ervas marinhas	Sapal	TOTAL
Area (ha)	1545	3734	5279
C stock (t)	100 000	280 000	380 000
Remoção de C (t/ano)	1 060	1 080	2 140

Restauro de ECAs



A cor do Carbono Azul

Obrigado, Muchas Gracias

