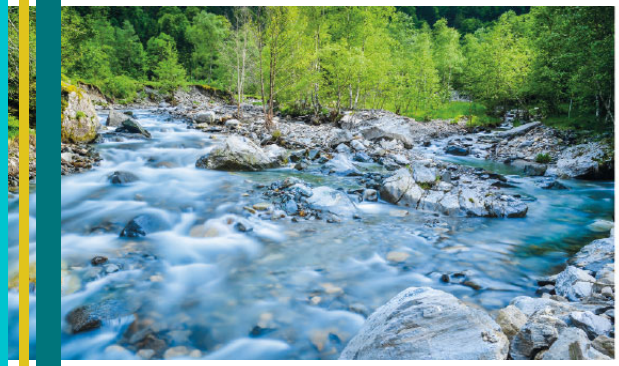
aquacross

ESP EUROPE
2018 REGIONAL CONFERENCE
Ecosystem services in a changing world: moving from theory to practice
SAN SEBASTIÁN, SPAIN
15-19 OCTOBER 2018



Participatory coastal management through elicitation of ecosystem service preferences and modelling driven by "coastal squeeze"

Javier Martínez-López, Heliana Teixeira, Mariana Morgado, María Almagro, Ana I Sousa, Ferdinando Villa, Stefano Balbi, Ana Genua-Olmedo, Antonio J A Nogueira, Ana I Lillebø

16/10/2018

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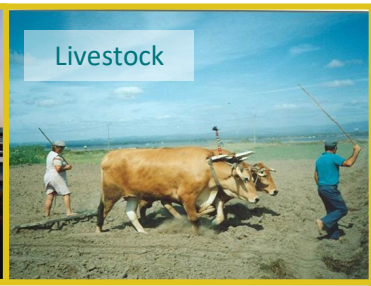
The Baixo Vouga Lagunar
Ria de Aveiro coastal lagoon – Portugal

- Special Protection Area under the EU Habitats and Birds Directives
- Natura 2000 Network of protected areas distinctive feature – "is not a system of strict nature reserves from which all human activities would be excluded, but instead centres its approach on people working with nature rather than against it"
- Natura 2000 message: ensure that these sites are "managed in a sustainable manner, both ecologically and economically"

Saltpans


Livestock

Agriculture

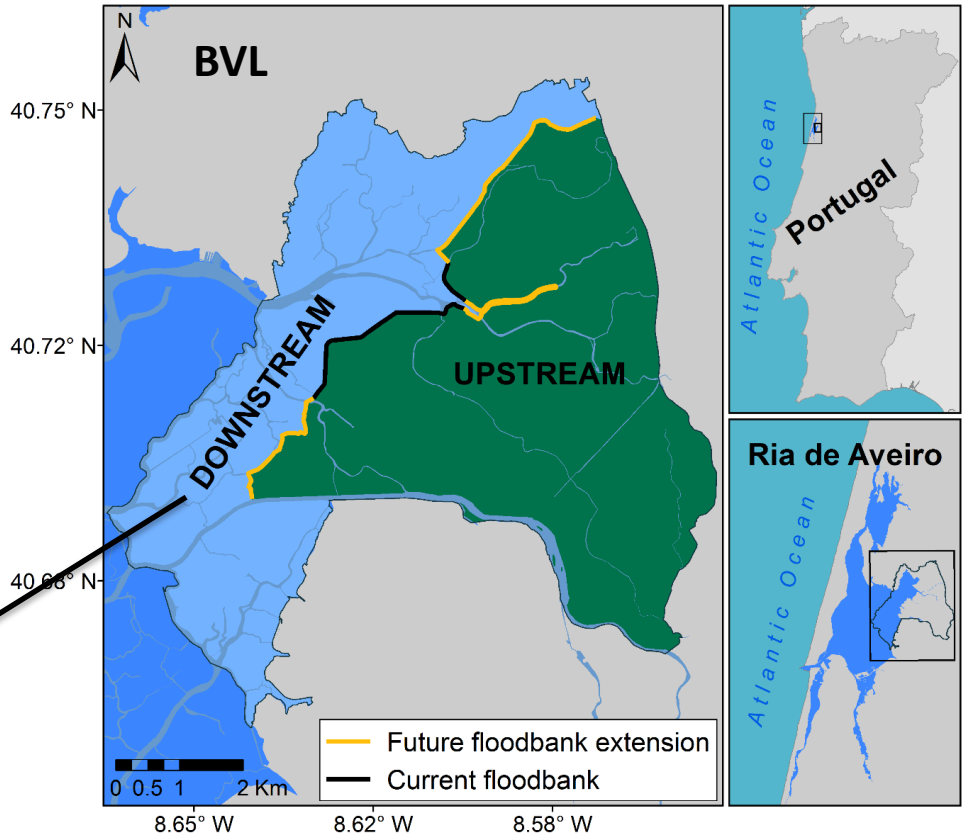
10/28/2018

Bait
Shelfish harvest

The Baixo Vouga Lagunar context

- Prevent surface salt water intrusion during high tide periods into agriculture fields: floodbank extension

- Changes in the hydro-ecological dynamics:
  - the water level downstream expected to rise
  - increased submersion period of tidal wetlands



Summary of the Methodology

1. We have modelled saltmarsh plant species and habitats under a coastal squeeze scenario

2. Mapped ecosystem services based on expert valuation (semi-quantitative)

3. Ecosystem services were prioritized according to stakeholders' preferences

4. Key areas for ES provision were established using spatial multi-criteria analysis (smca)

1. Saltmarsh plant species models

- Four species:
  - % coverage (adapted Braun-Blanquet);
  - 13 transects (100 m);
  - 5 campaigns: 2004 (Aut/Win), 2005 (Spr); 2005 (Aut), 2006 (Spr), 2015 (Spr)

- Explanatory variables:
  - Salinity
  - Elevation/Bathymetry m
  - Distance to streams m
  - Percentage of tides above critical level yearly ~ submersion period

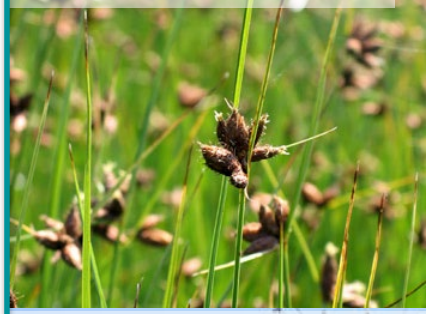
- Species distribution models: GLM betareg

Halimione portulacoides

Phragmites australis

Bolboschoenus maritimus

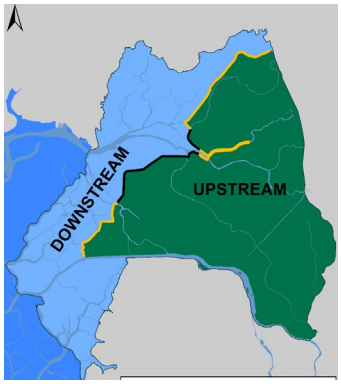
L. Lopes 2005 www.biorede.pt

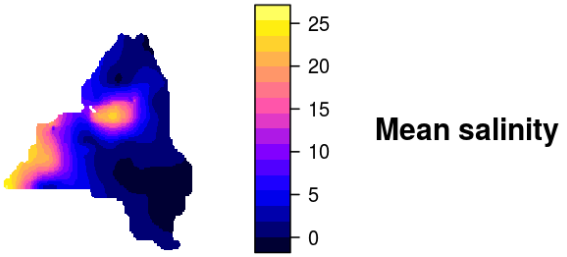


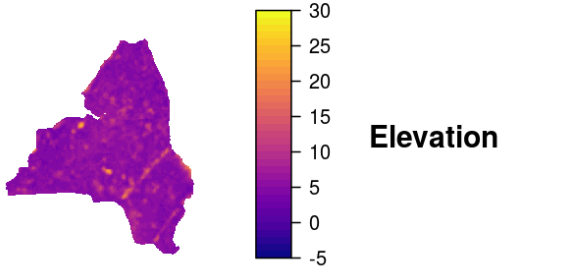
Juncus maritimus

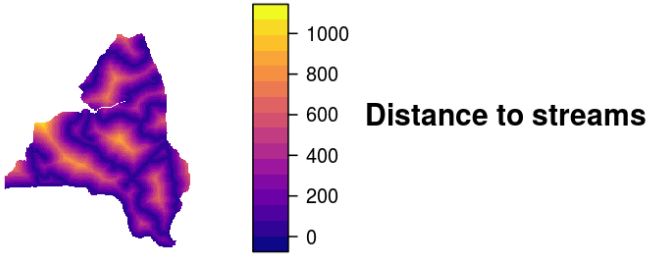
L. Lopes 2005 www.biorede.pt

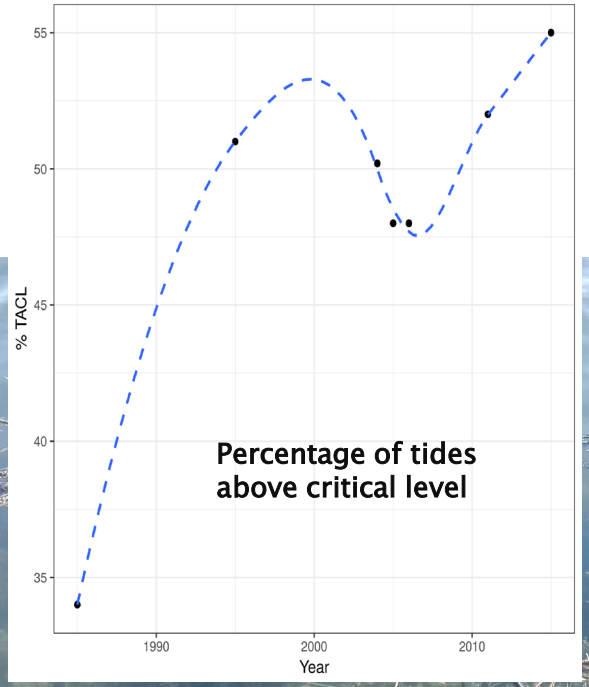
Explanatory variables

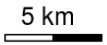




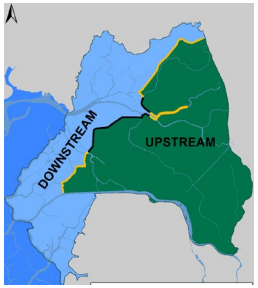




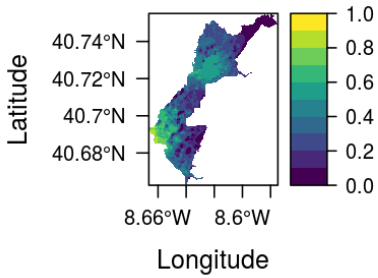




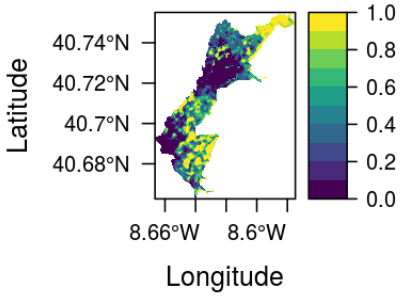
SDMs output



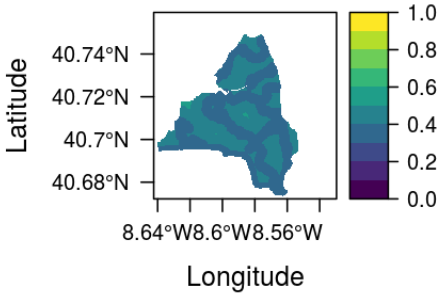
H. portulacoides



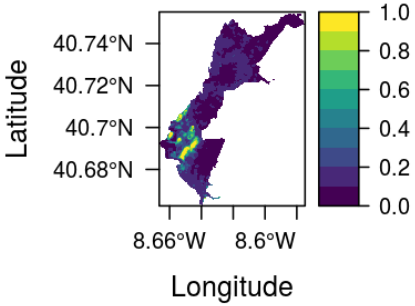
P. australis



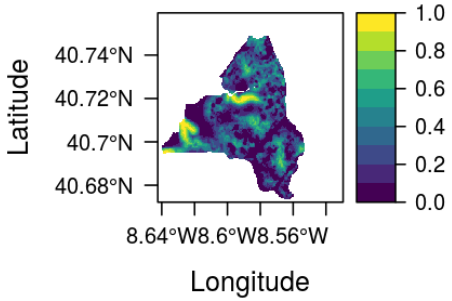
P. australis



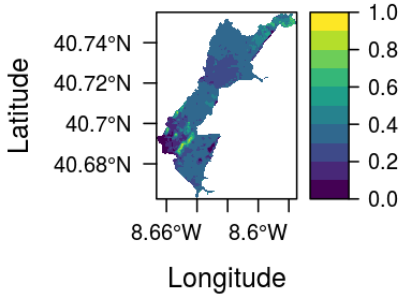
B. maritimus



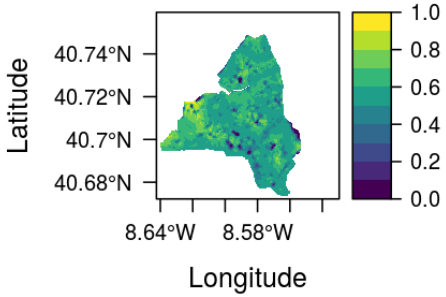
B. maritimus



J. maritimus



J. maritimus



Halimione portulacoides

Phragmites australis

Bolboschoenus maritimus

L. Lopes 2005 www.biorede.pt

Juncus maritimus

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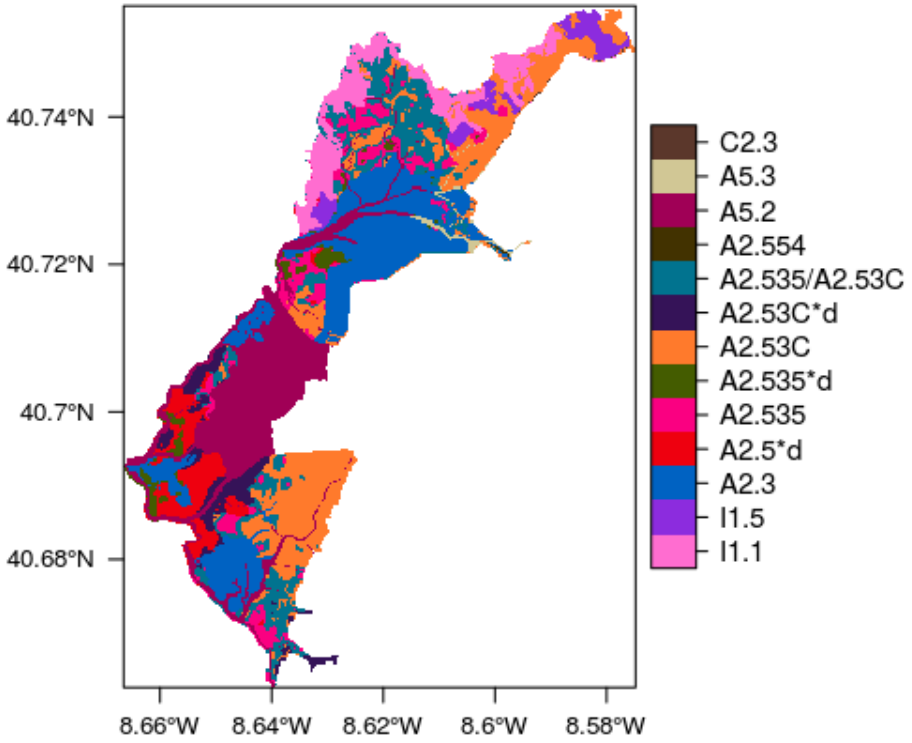
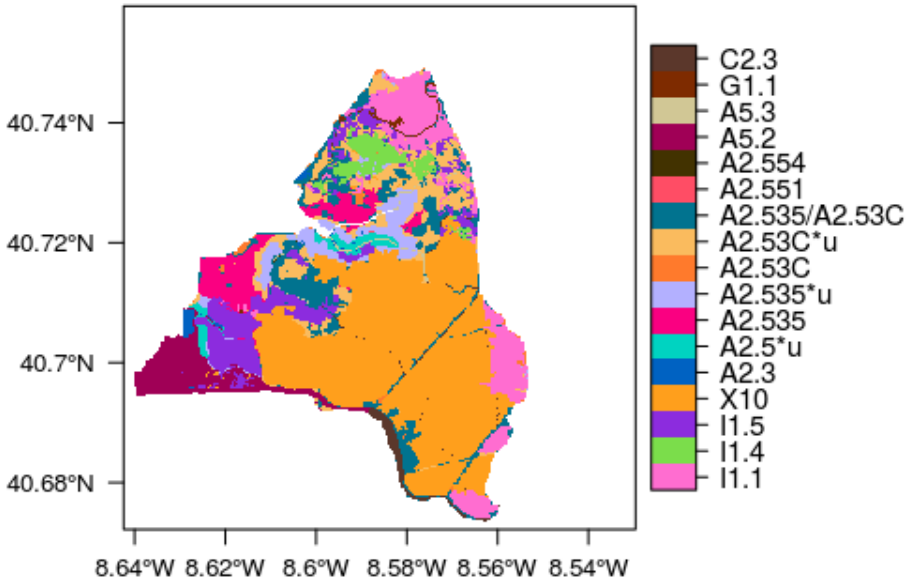
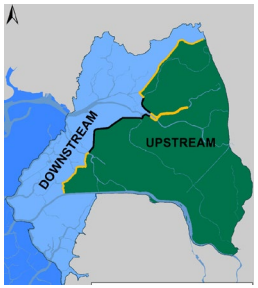
From species distribution to habitats

- Adapted the EEA EUNIS habitat classification 2012 (incl. typical associations observed along the gradient)
- Based on predicted relative cover of species (modelled)
- Multivariate classification analysis (hierarchical clustering)
- IndVal analysis (indicator species)

Predicted habitats mapping



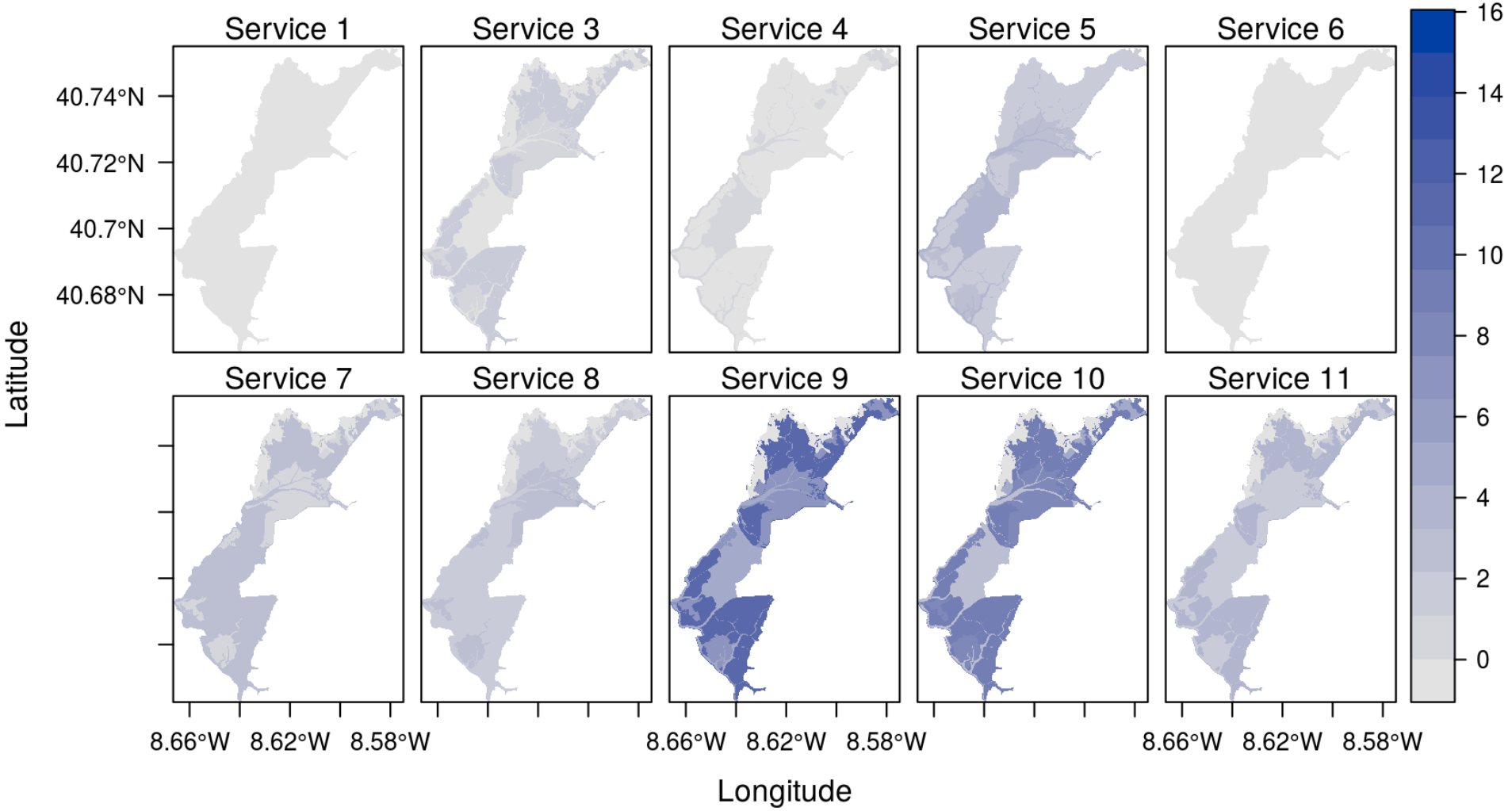




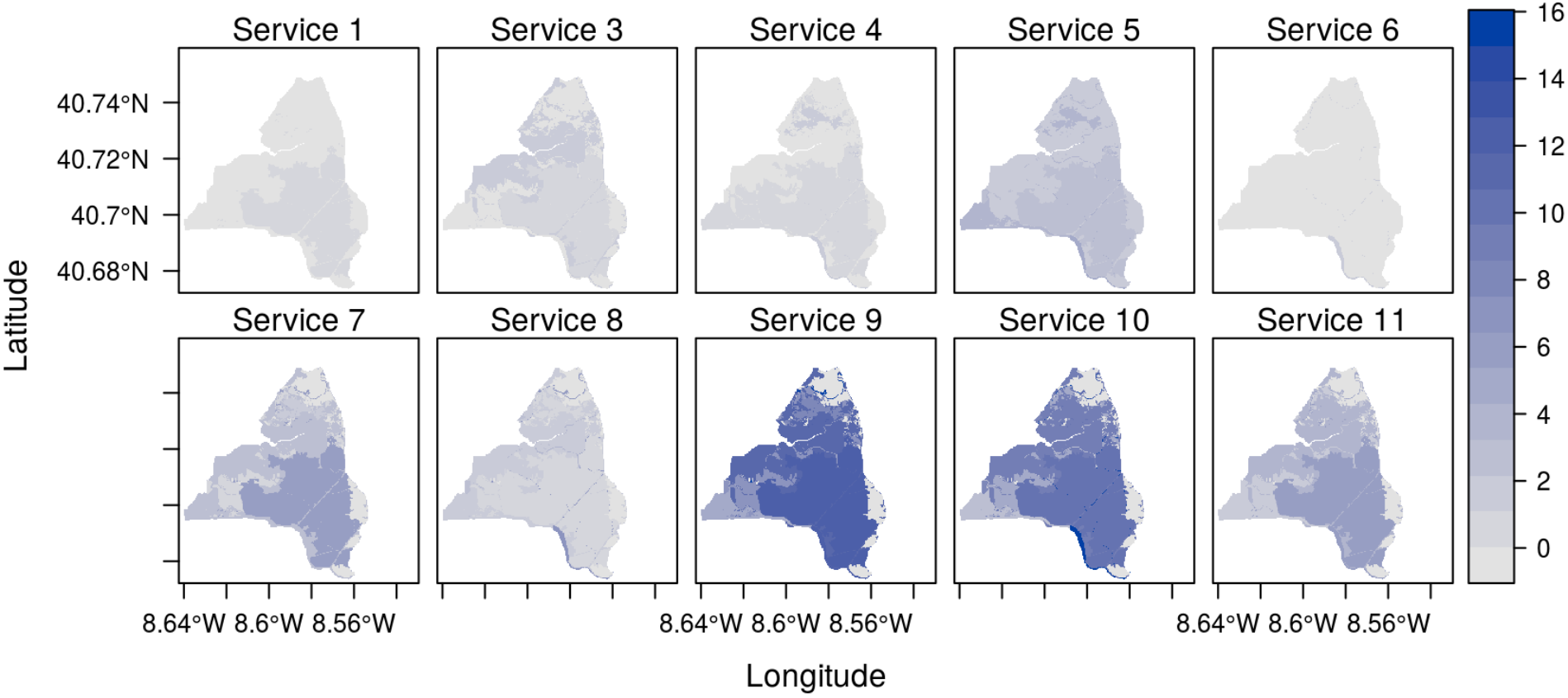
2. Ecosystem service proxies

- CICES classification
- Potential to supply ES expert knowledge valuation (0, 1, 2)
  - lookup table based on the contribution of habitats and associated mobile biotic groups
- ES summarized into 11 types:
  - (1) Biotic based energy sources;
  - (2) Abiotic energy sources
  - (3–4) biotic/abiotic materials;
  - (5–6) nutritional biotic/abiotic substances;
  - (7) mediation of flows;
  - (8) mediation of waste toxics and other nuisances;
  - (9) maintenance of physical chemical biological conditions;
  - (10) physical and intellectual interactions with biota, ecosystems, land and seascapes environmental settings;
  - (11) spiritual symbolic and other interactions with biota ecosystems and land seascapes environmental settings

ES mapping downstream



ES mapping upstream



3. Elicitation of preferences

- Workshop with stakeholder (n=17 individuals):
  - (1) Policy / Governance,
  - (2) Public Administration,
  - (3) Citizens,
  - (4) Environmental scientists,
  - (5) Interest groups and
  - (6) Business
- Pairwise comparison of ES (*AHP ranking*) *using online form*
- Analysis of responses (*Consistency ratio of individual judgements ICR*)
- Multivariate classification analysis of individuals (*hierarchical clustering*) to identify main groups
- Spatial Multicriteria Analysis to identify priority areas (SMCA – EVAMIX)

Serviços dos Ecossistemas (seres vivos)

CULTURAL

INTERAÇÕES FÍSICAS E INTELECTUAIS COM O AMBIENTE

INTERAÇÕES FÍSICAS (CONTACTO DIRETO)

SE10

CÓDIGO
ESS_C_PhysIntel_PhysicalExperientialInteractions

DESCRIÇÃO
Interações físicas entre o Homem e a Natureza para fins de entretenimento

EXEMPLOS
Observação de aves, *snorkeling*, mergulho, caminhada, escalada, passeios de barco, pesca de lazer (pesca à linha) e caça de lazer

HABITAT(S) ONDE OCORRE:

A (A2.2, A2.22, A2.3, A2.5, A2.535, A2.53C, A2.61, A7)
Habitats marinhos
Praias, sapais costeiros, pradarias marinhas, bancos de areia, lodaçais e coluna de água

B (B1.3, B1.4, B1.6, B1.7, B1.8)
Dunas costeiras
Dunas herbáceas, arbustivas e arbóreas (pinhal litoral)

C (C1, C1.3, C2.3, C3.21, C3.22)
Lagos, Rios e Zonas húmidas de água doce
Lagos, rios, juncais e caniçais dulçaquícolas

E5.44 e G1 (G1.1, G1.21, G1.22 G1.31)
Habitats ripícolas
Habitat ripícola arrelvado, bosque paludoso, amial ripícola, ulmeiros e freixos

J5 (J5.11, J5.12)
Habitats construídos, industriais e artificiais
Aquacultura e Salinas (Marinhas)

X10
Bocage
Mosaico de campos de cultivo e pastagens

Serviços dos Ecossistemas (seres vivos)

PROVISIONAMENTO

NUTRIÇÃO

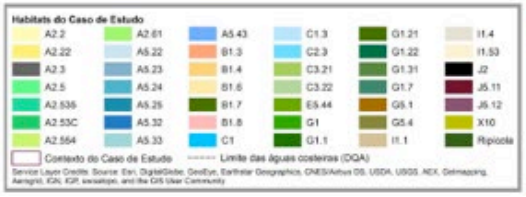
BIOMASSA

SE5

CÓDIGO
ESS_P_Nut_Biomass

DESCRIÇÃO
Produção de bens alimentares

EXEMPLOS
Peixes de água doce (sável); Peixes migradores (enguia, lampreia); Peixes de água salgada (solha, robalo); Marisco (crustáceos, moluscos); Cereais (arroz, trigo, milho); Aquacultura (dourada, robalo, ostras, bivalves)



HABITAT(S) ONDE OCORRE:

A (A2.2, A2.22, A2.3, A2.5, A2.535, A2.53C, A5.22, A5.23, A5.25, A5.32, A5.33, A5.43, A7)
Habitats marinhos
Praias, sapais costeiros, bancos de areia, lodaçais, sedimento infralitoral e coluna de água (ria e mar)

C (C1, C1.3, C2.3)
Lagos e Rios
Lagos, lagos permanentes eutrofizados e rios

E5.44 & G1 (G1.1, G1.21, G1.22 G1.31)
Habitats ripícolas
Habitat ripícola arrelvado, bosque paludoso, amial ripícola, ulmeiros e freixos

I1 (I1.1, I1.5)
Agricultura
Terrenos aráveis e cultivados, pousios.

J5 (J5.11, J5.12)
Habitats construídos, industriais e artificiais
Aquacultura e Salinas (Marinhas)

X10
Bocage
Mosaico de campos de cultivo e pastagens

Stakeholder questionnaire

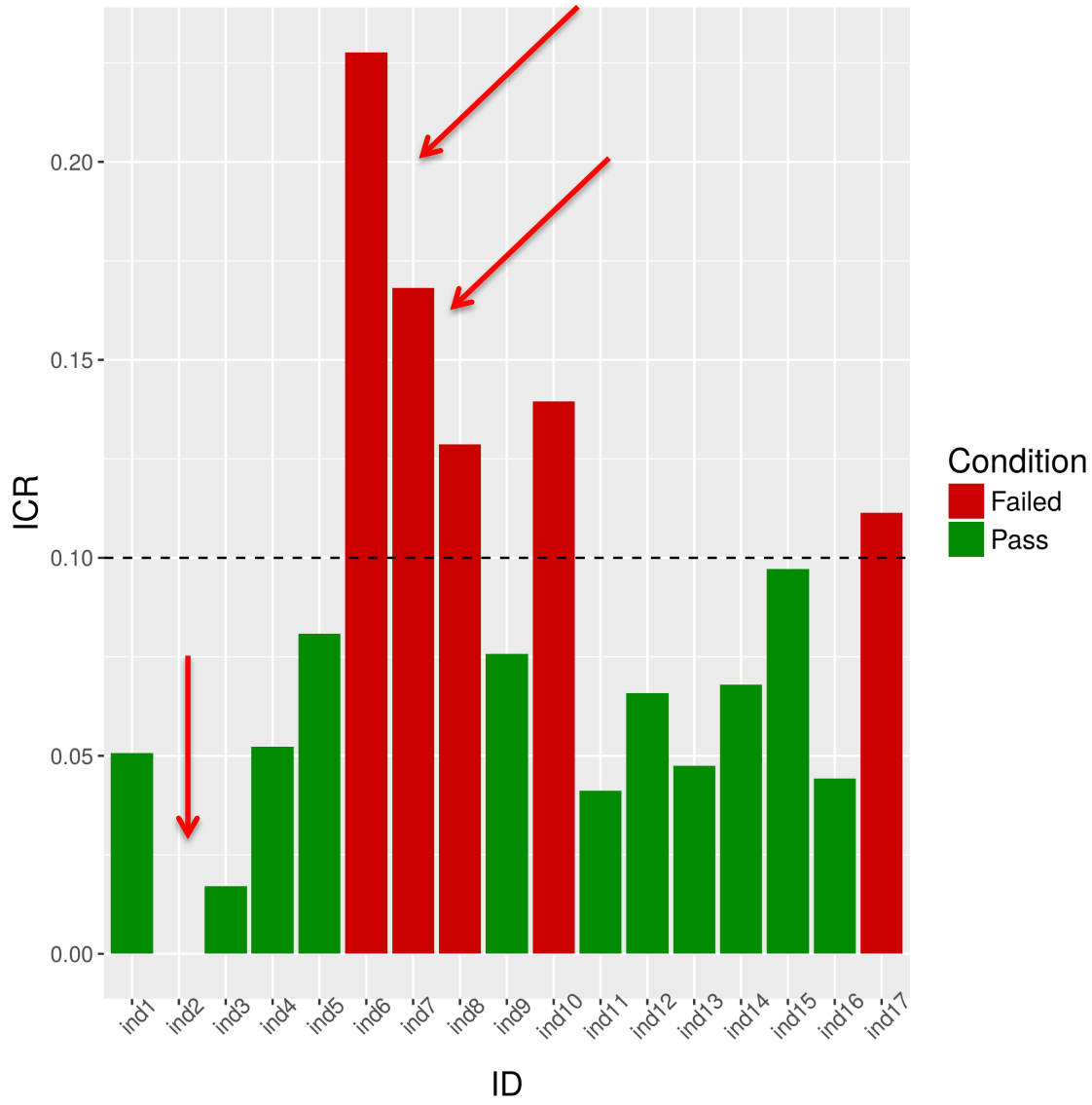
Analytic hierarchy process (AHP)

Qual a importância do SE1 "Provisionamento de Energia proveniente de seres vivos" em relação ao... *

	muito menos imp...	menos importante	igualmente impo...	mais importante	muito mais impo...
SE2 Provisionam...	○	○	○	○	○
SE3 Provisionam...	○	○	○	○	○
SE4 Provisionam...	○	○	○	○	○
SE5 Provisionam...	○	○	○	○	○
SE6 Provisionam...	○	○			
SE7 Regulação & ...	○	○			
SE8 Regulação & ...	○	○			
SE9 Regulação & ...	○	○			
SE10 Cultural: Int...	○	○			

Likert-type scale:
5 levels bidirectional ordinal scale,
with equivalent number of negative and positive statements

Consistency ratio of individual judgements



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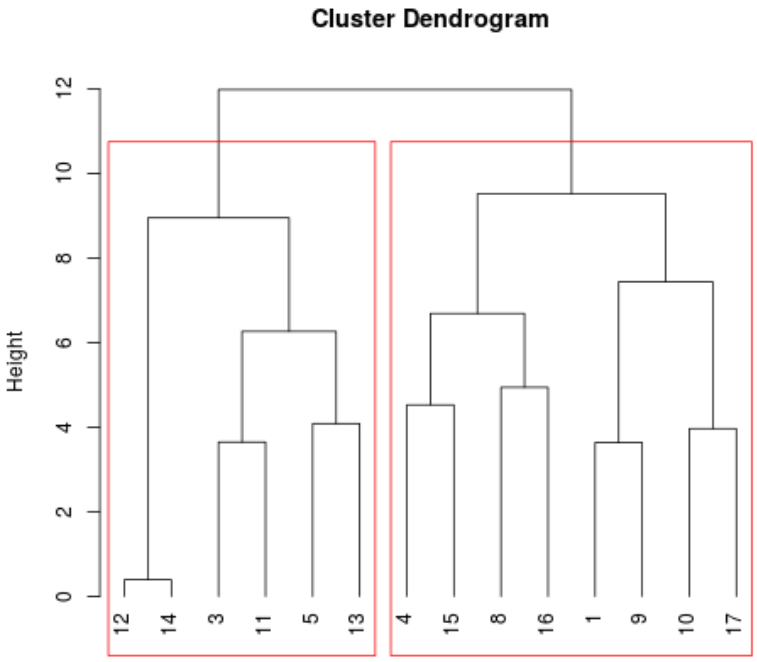
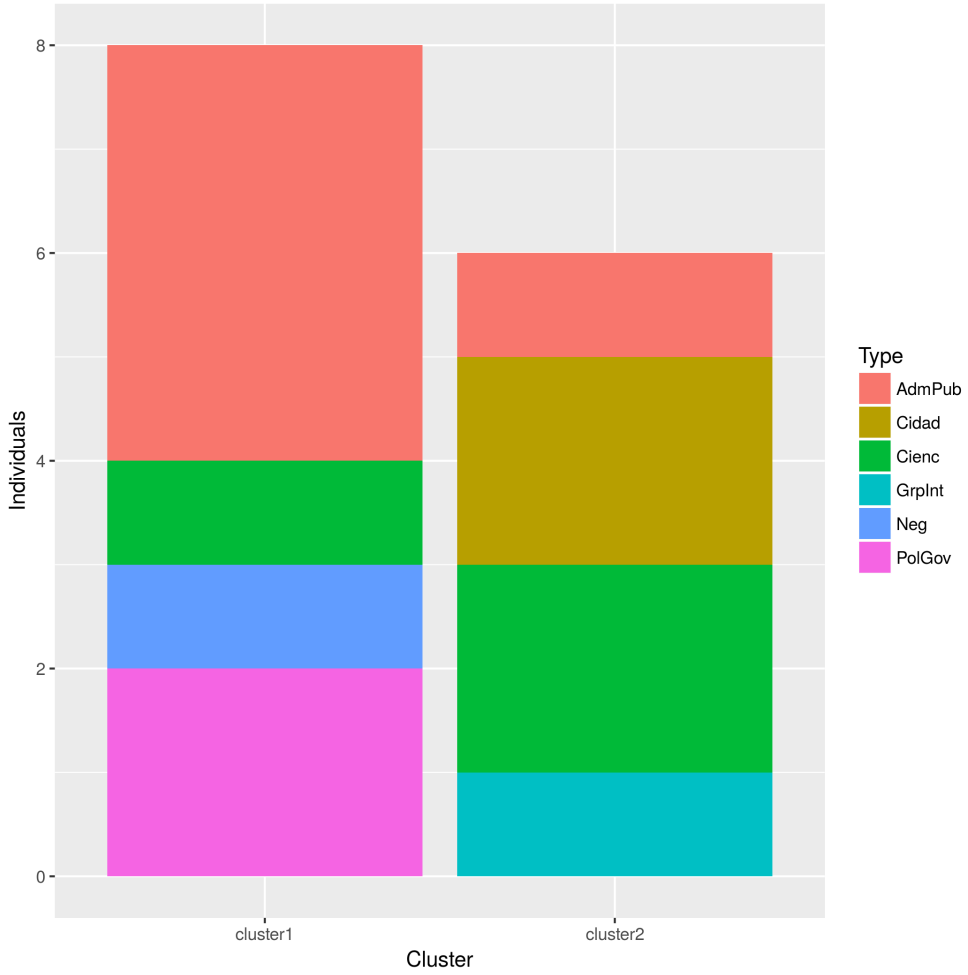


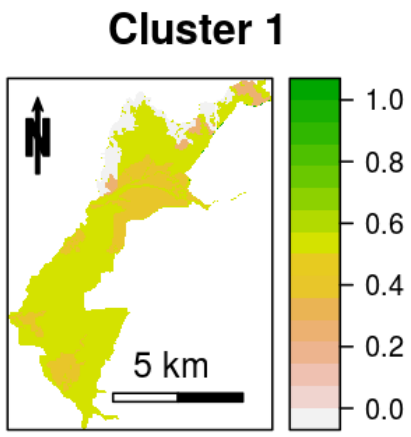
Minimum relative similarity within group 25 %

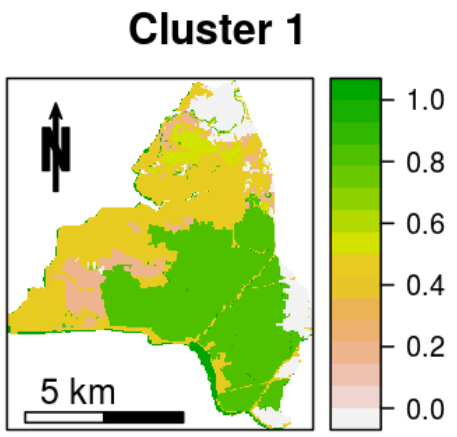


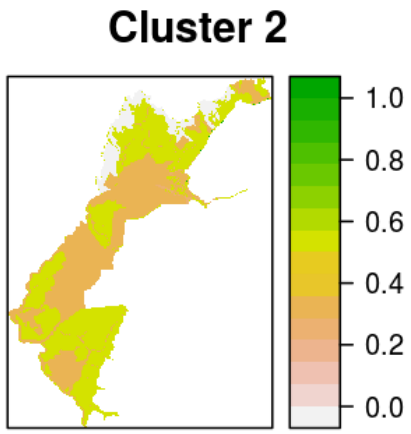
Mean weights of each Ecosystem Service per cluster

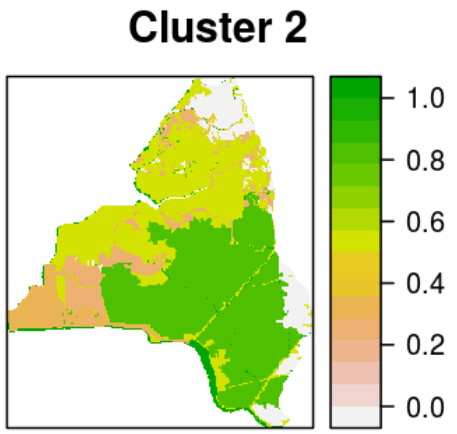
1 (most important) to 10 (less important)

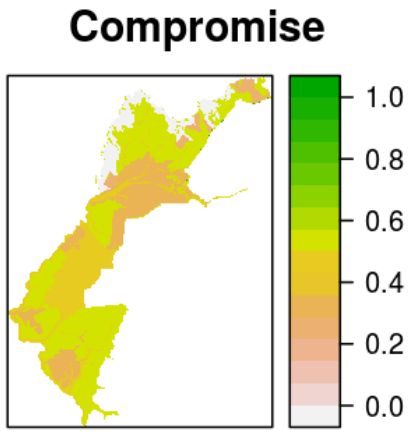
Ecosystem Service	Cluster 1	Cluster 2	Compromise
ES1	4	5.2	4.6
ES3	4.1	3.7	3.9
ES4	5.9	1.6	3.7
ES5	1	10	5.5
ES6	6	1	3.5
ES7	1.4	6.6	4
ES8	4.2	8.5	6.3
ES9	7.1	9.3	8.2
ES10	8	2.1	5.1
ES11	10	1.3	5.7

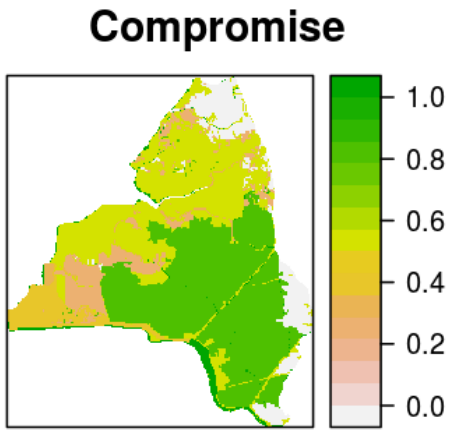












Conclusions

- Our results indicate the main areas to be preserved at the BVL scale:
  - the traditional agricultural mosaic fields with a woodland element (*bocage*)
  - the freshwater courses and
  - the subtidal estuarine channels

- At the scale of the entire Nature 2000 site:
  - Idenfitication of compensation sites for saltmarshes and wetlands restoration

- Co-building: by combining ecology with the analysis of social preferences, management can be informed for improving the conservation of coastal ecosystems

STOTEN *special virtual issue* "**EBM in aquatic systems**"
Martínez-Lopez et al. under revision
Lillebo et al. 2019

Thank you very much for your attention!

BASQUE CENTRE FOR CLIMATE CHANGE
Klima Aldaketa Ikergai
Sustainability, that's it!

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