ECOSYSTEM SERVICES OF RIPARIAN FORESTS IN UNCERTAIN HYDROLOGICAL AND LAND-USE FUTURES

Francisca C. Aguiar | Rui Rivaes| P Segurado | M Teresa Ferreira | L Schmidt | MJ Feio | S Almeida | MR Fernandes | A. Correia | A. Calapez | A Delicado | A Mortágua | C Vieira | D Gebler | I. Lozanovska | J Sá Couto | M Sales | MJ Martins | PC Silva

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Institute of Botany Slovak Academy of Sciences
cef Centro de Estudos Florestais
FCT Fundação para a Ciência e a Tecnologia
Lisb@20[20]
COMPETE 2020
PORTUGAL 2020
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RIVERS, RIVERINE ECOSYSTEMS AND HUMANS CONCUR FOR SPACE, WATER AND ENERGY.

Riparian forests are multifunctional ecotones that generate a range of goods and services to human well-being and society, collectively called Ecosystem Services.

Riparian forest Values and Ecosystem services in uncertain freshwater futures and Altered Landscapes

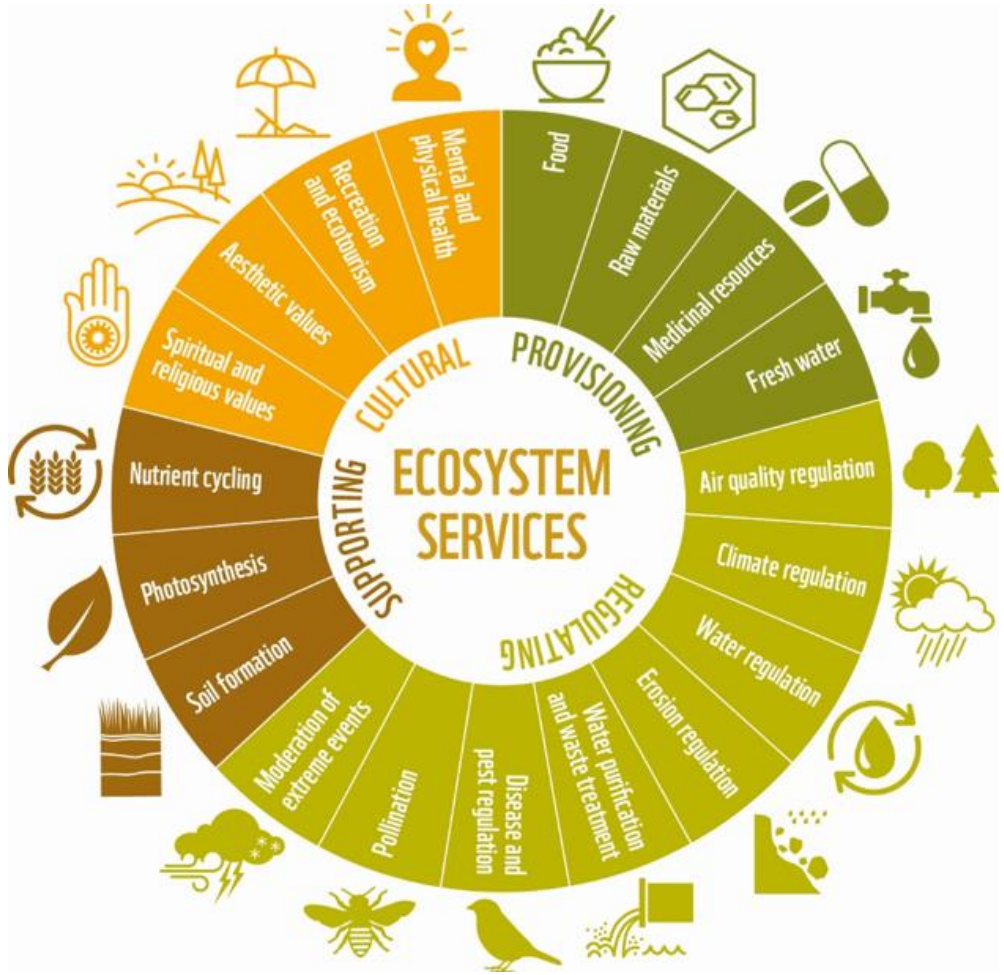
RIVEAL aims to quantify key-Ecosystem Services of riparian forests, and predict the gains/losses of ES under diverse climatic, land use and water management scenarios in the Portuguese fluvial landscapes.

RIVEAL

Context

Ecosystem Service	ES Importance High to Low
Providing habitats	
Filtering/storage particules	
Carbon fixation	
Erosion control	
Providing habitats for native pest control agents	
Removal of nutrients in runoff	
Landslide	
Evaporative cooling	
Standing crop of woody biomass	
Seeds, spores and harvestable genes	
Protection against fires	
Standing crops of non-woody biomass	
Harvestable volume of wild berries or other	
Seed and propagule dispersal	
Socio-cultural values	

High | Medium | Low | Unknown



Source: WWF

Global Overview of Ecosystem Services Provided by Riparian Vegetation

TENNA RIIS, MARY KELLY-QUINN, FRANCISCA C. AGUIAR, PARASKEVI MANOLAKI, DANIEL BRUNO, MARIA D. BEJARANO, NICOLA CLERICI, MARIA ROSÁRIO FERNANDES, JOSÉ C. FRANCO, NEIL PETTIS, ANA P. PORTELA, OLGA TAMMEORG, PRIIT TAMMEORG, PATRICIA M. RODRIGUEZ-GONZÁLEZ, AND SIMON DUFOUR

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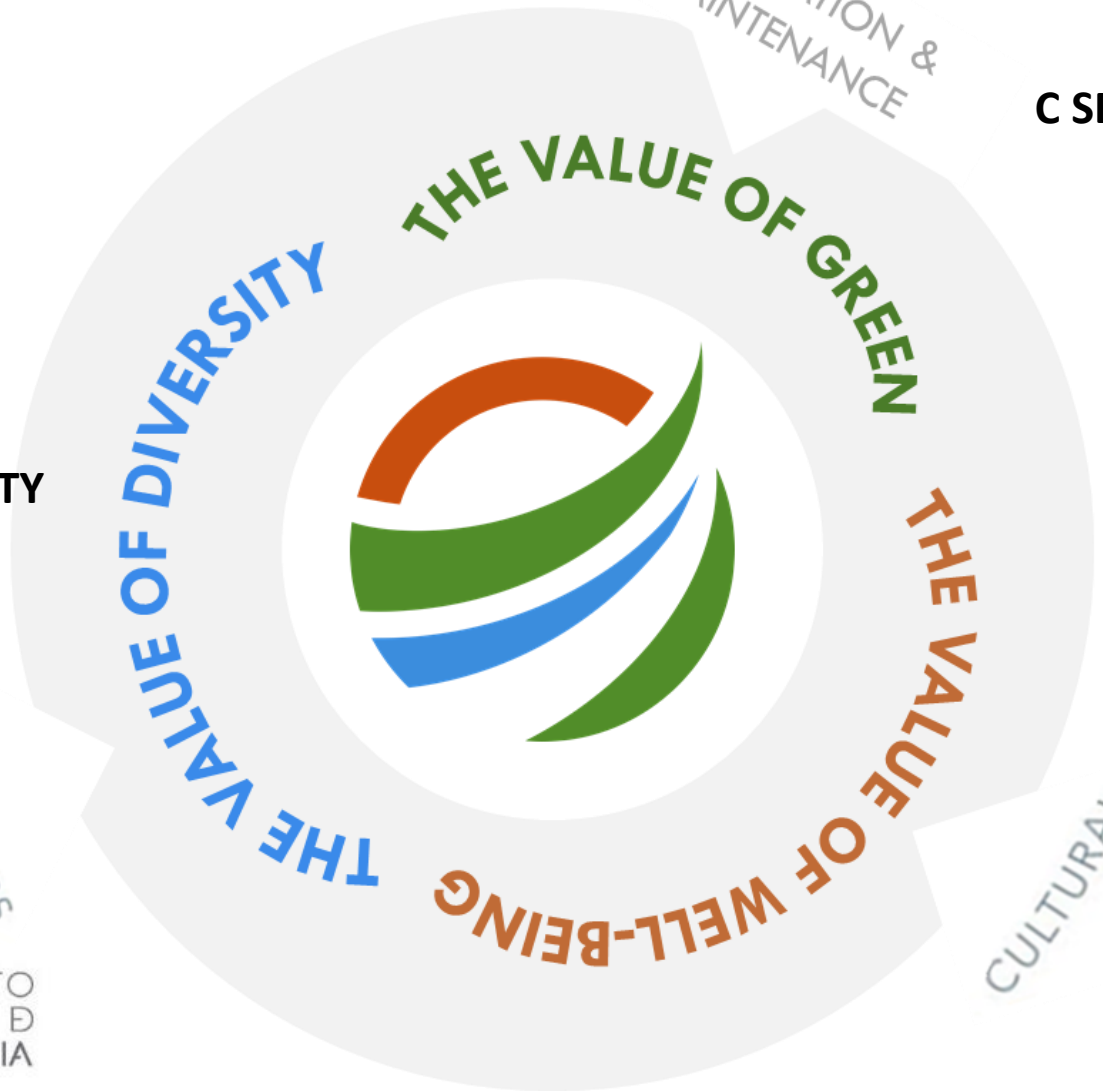
REGULATION & MAINTENANCE

C SEQUESTRATION

FLUVIAL ECOLOGICAL INTEGRITY



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CULTURAL SERVICES

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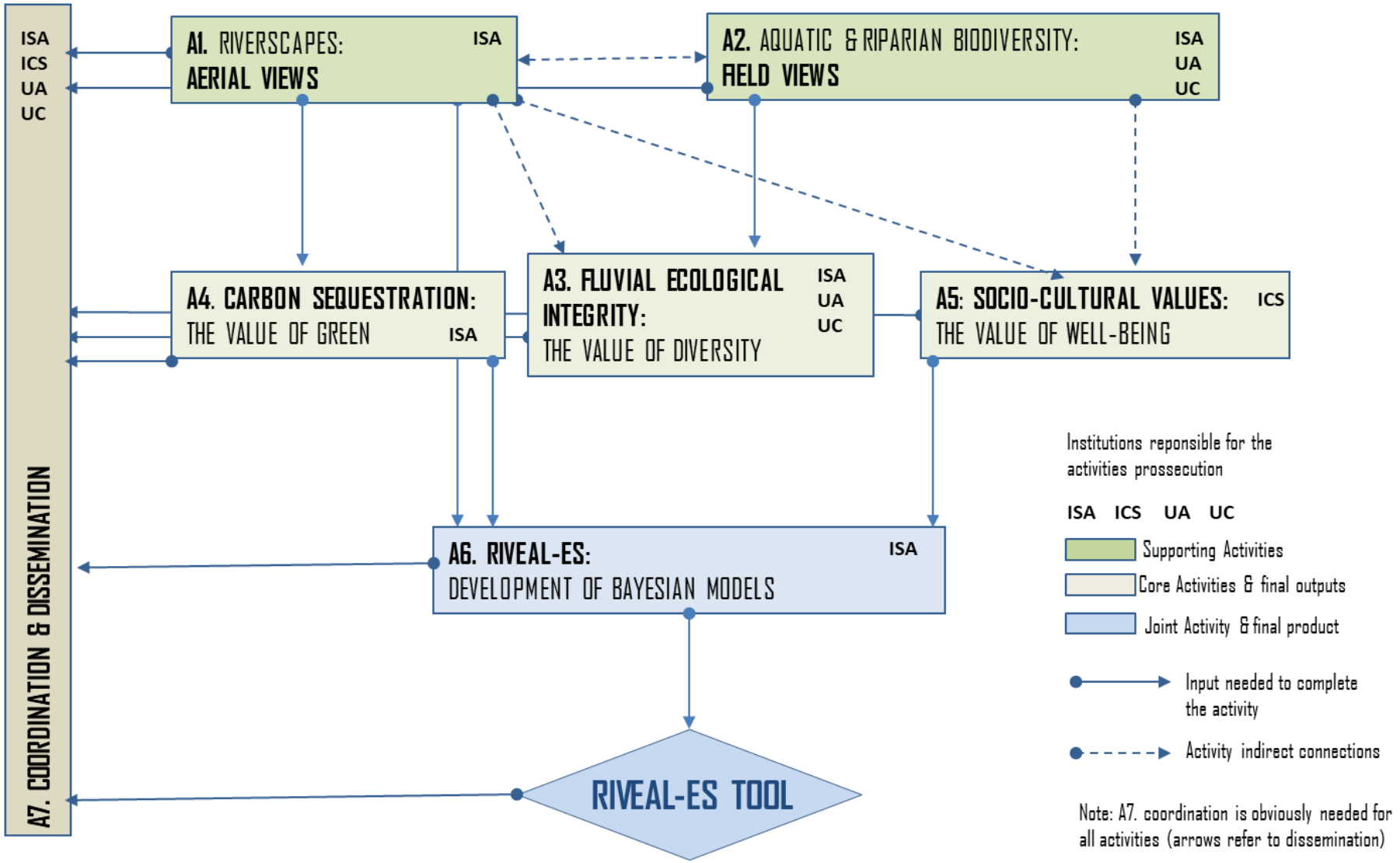
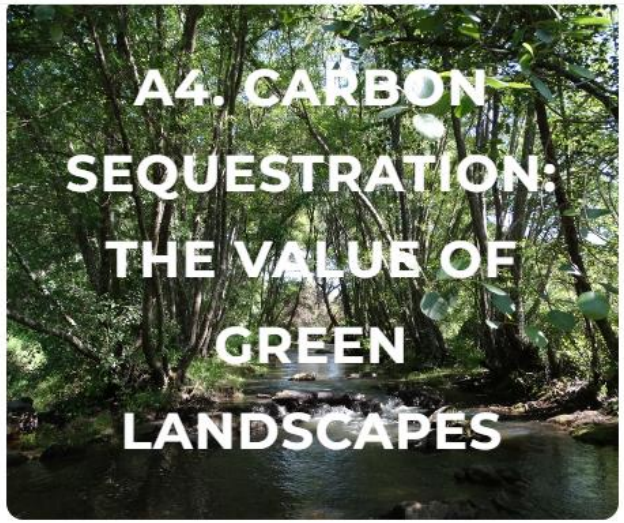
RIVEAL ACTIVITIES WORKFLOW

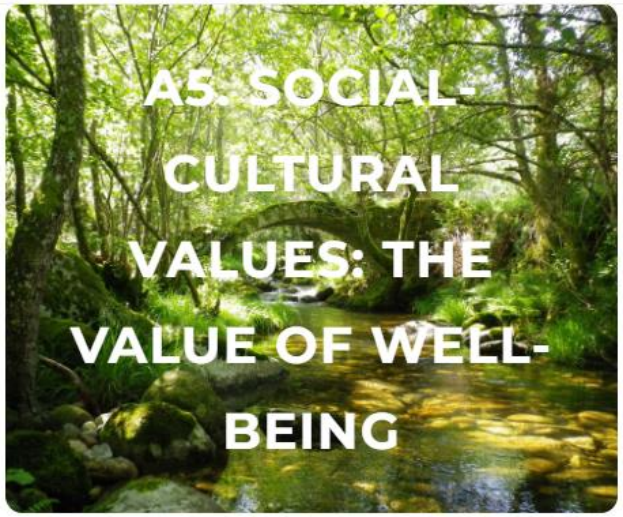


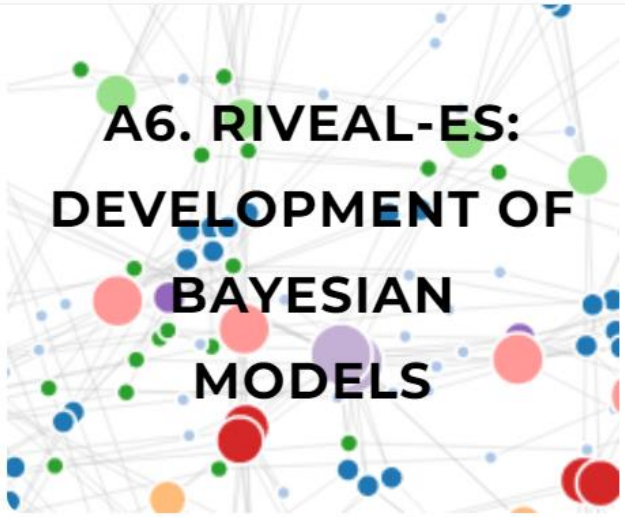

A1. RIVERSCAPES: AERIAL VIEWS


A2. AQUATIC & RIPARIAN BIODIVERSITY: FIELD VIEWS


A3. FLUVIAL ECOLOGICAL INTEGRITY: THE VALUE OF DIVERSITY


A4. CARBON SEQUESTRATION: THE VALUE OF GREEN LANDSCAPES

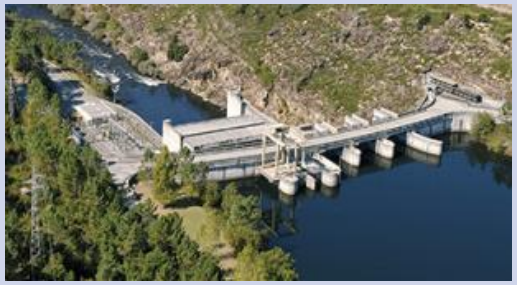

A5. SOCIAL-CULTURAL VALUES: THE VALUE OF WELL-BEING


A6. RIVEAL-ES: DEVELOPMENT OF BAYESIAN MODELS


A7. COORDINATION AND DISSEMINATION

Case studies

- We used two case studies – a **run-of-river dam** (Touvedo dam/River Lima) and a **storage reservoir** (Fronhas dam/Alva River), in Portugal



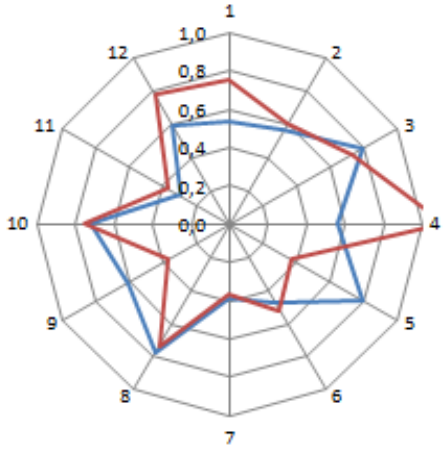
Run-of-river

(regulation capacity: 1%)

Storage reservoir

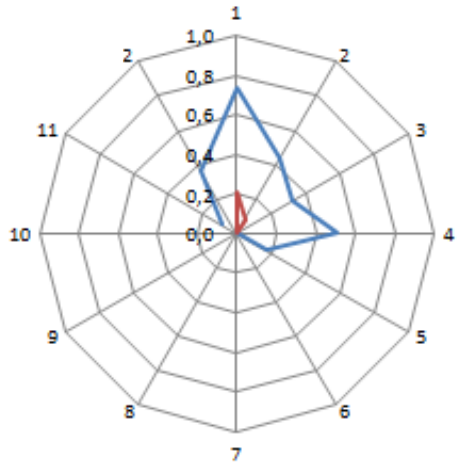
(regulation capacity: 13,1%)

Monthly flows (1 – January to 12- December)



Natural

Regulated



A1 UAV flight (River Lima/Touvedo dam)

https://youtu.be/2RSSe3YzoEY

https://riveal.pt/2021/07/12/how-to-estimate-the-carbon-stock-of-riparian-forests/

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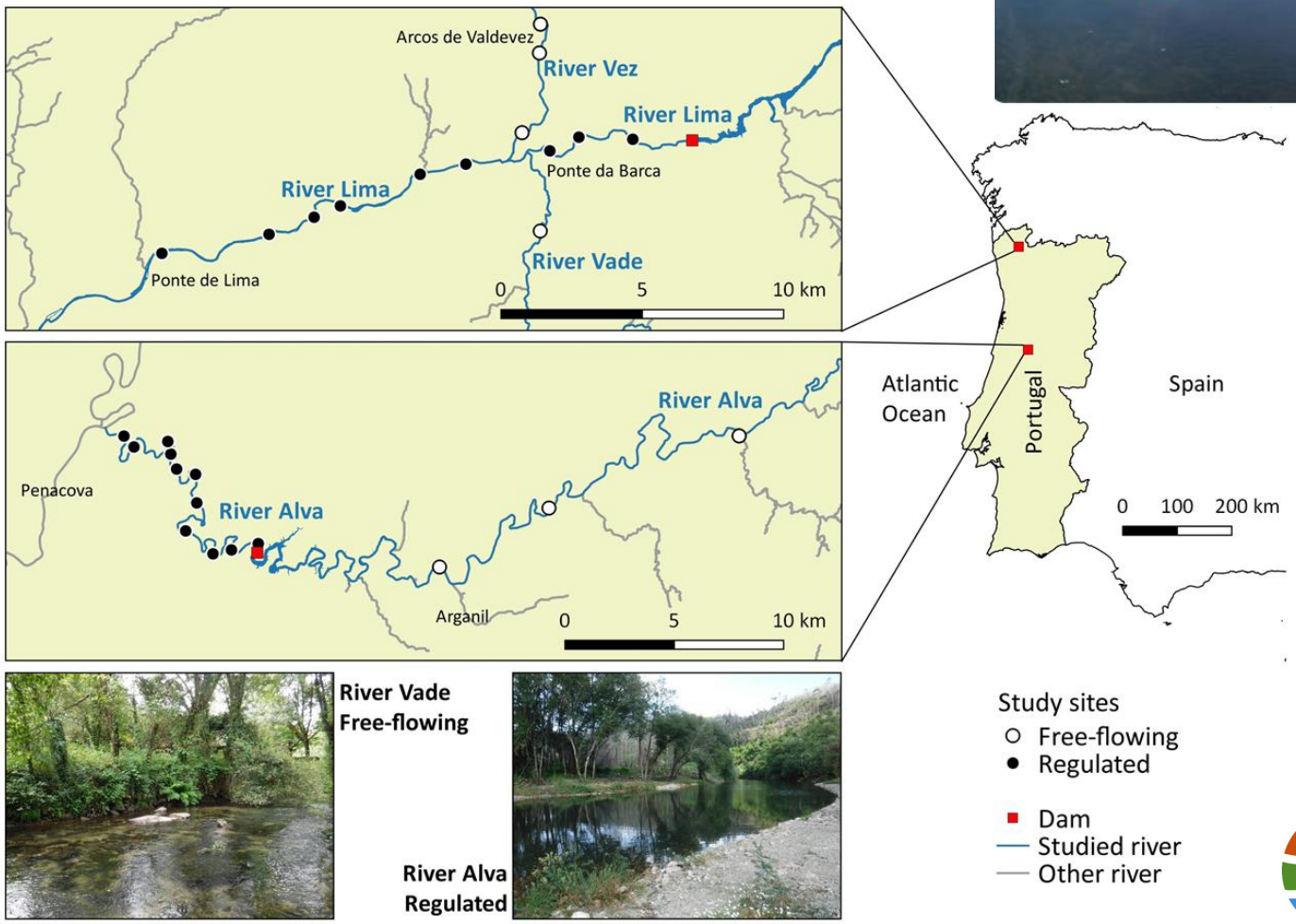
A2 Field sampling

- **Field data** downstream from Fronhas and Touvedo dams and reference data (upstream) June-July 2019

River Lima
Run-of-river

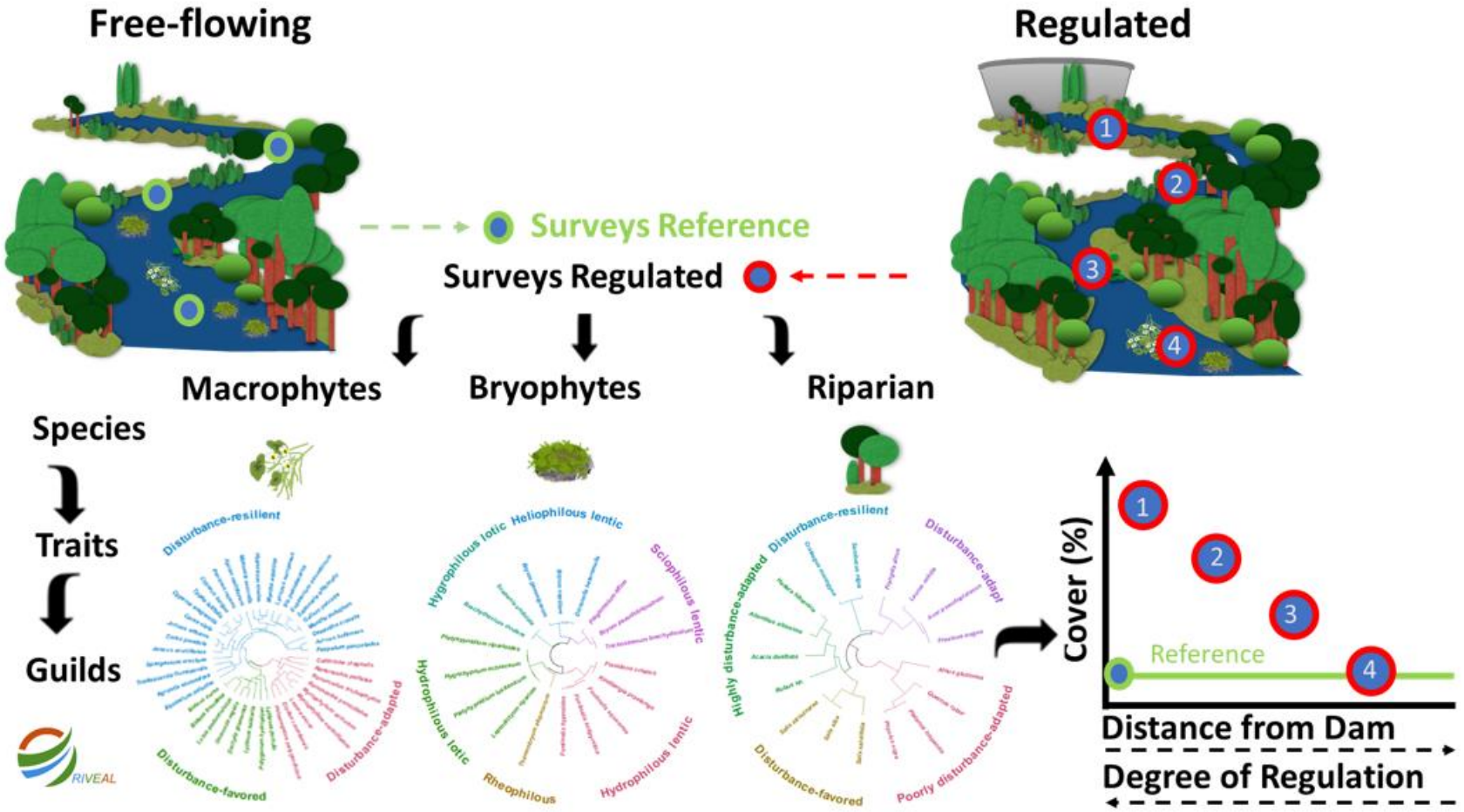
River Alva
Storage reservoir



A2 Field sampling

A3

The value of GREEN LANDSCAPES



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journal homepage: www.elsevier.com/locate/scitotenv

Streamflow regulation effects in the Mediterranean rivers: How far and to what extent are aquatic and riparian communities affected?

Ivana Lozanovska [a,*], Rui Rivaes [a], Cristiana Vieira [b], Maria Teresa Ferreira [a], Francisca C. Aguiar [a]

[a] Centro de Estudos Florestais, Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal
[b] Museu de História Natural e da Ciência da Universidade do Porto (MHNC-UP; UPorto/PRISC), Praça Gomes Teixeira, 4099-002 Porto, Portugal

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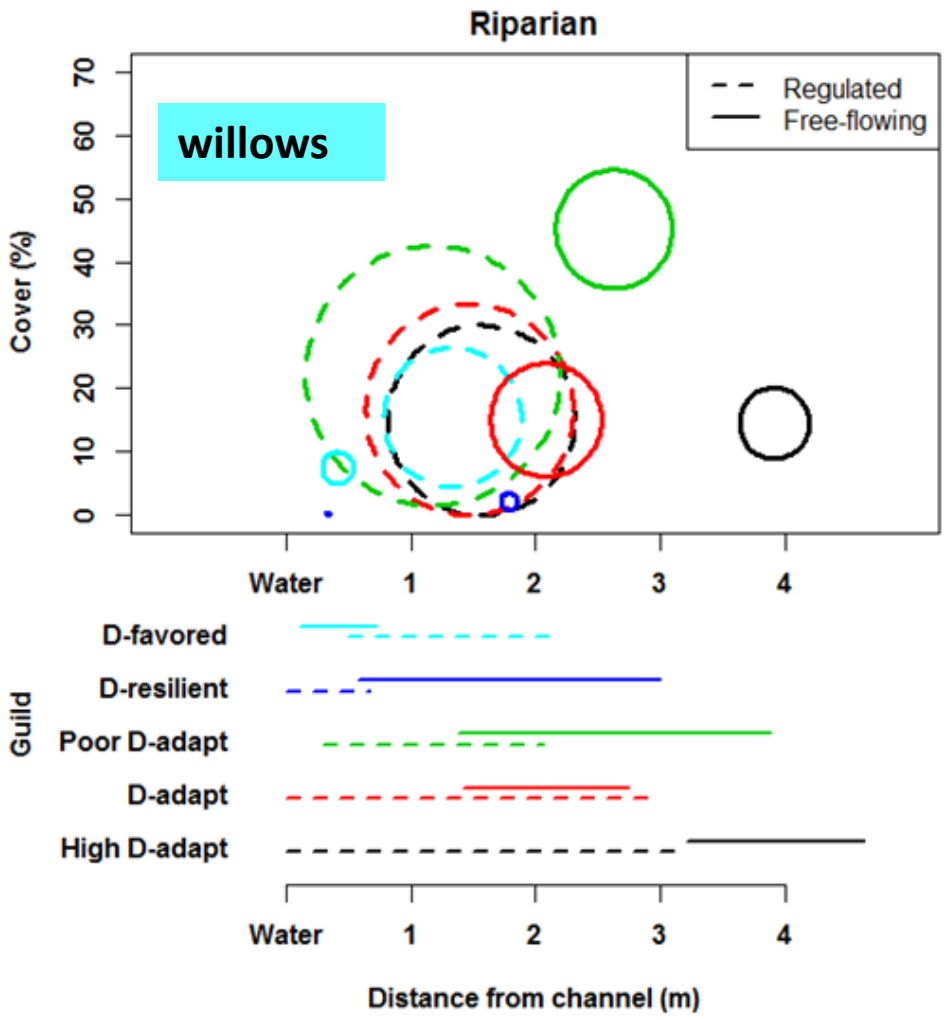
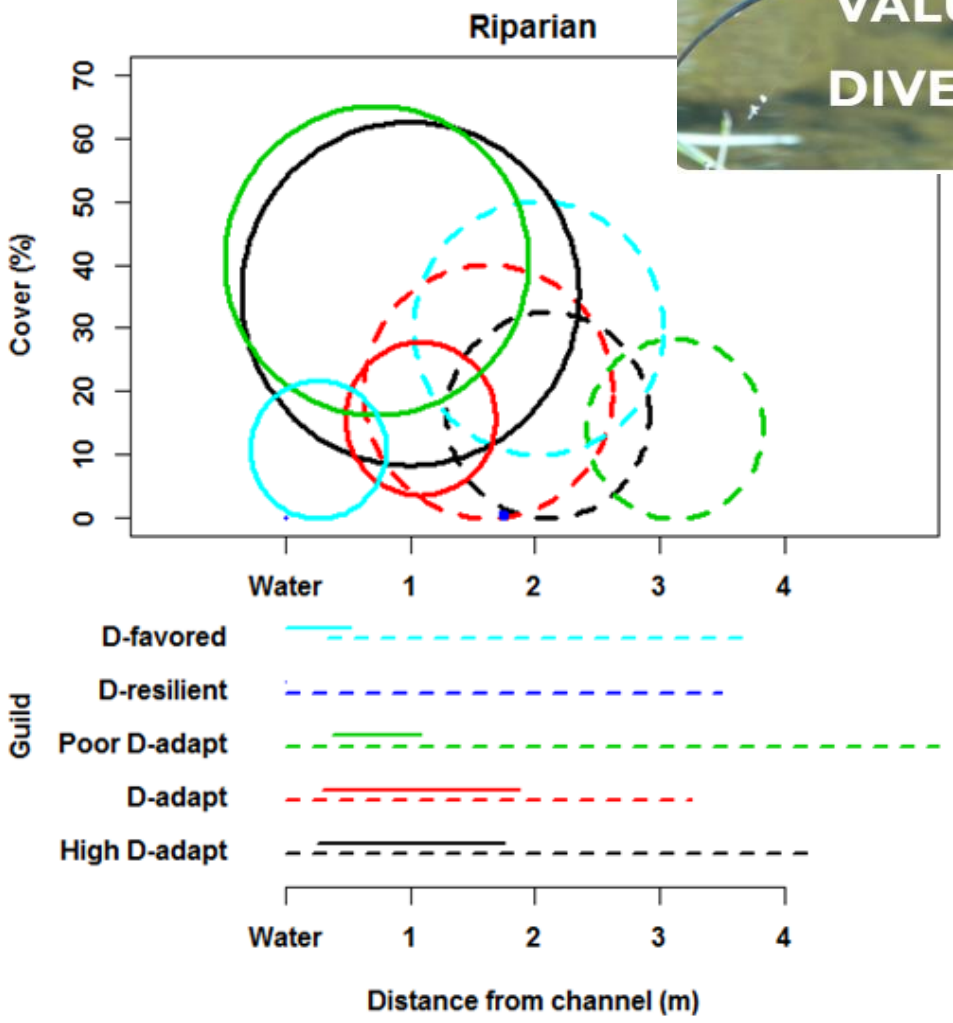
Spatial and functional changes

Reservoir



Run-of-river



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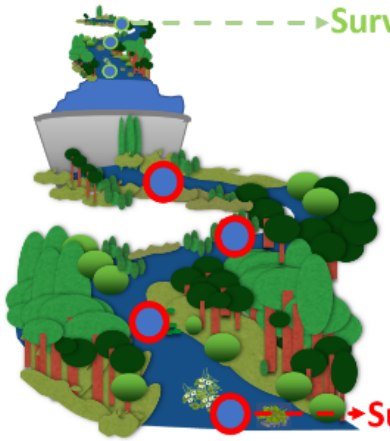
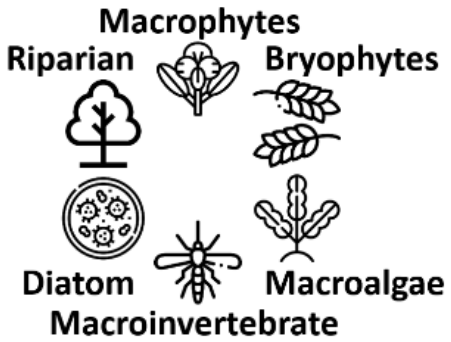
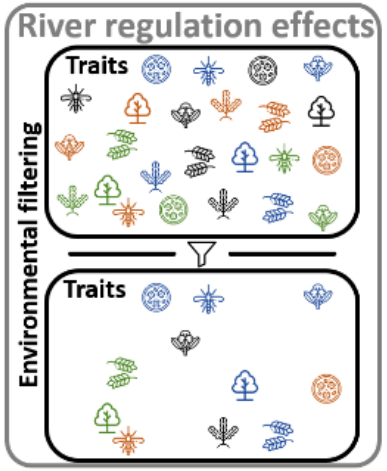
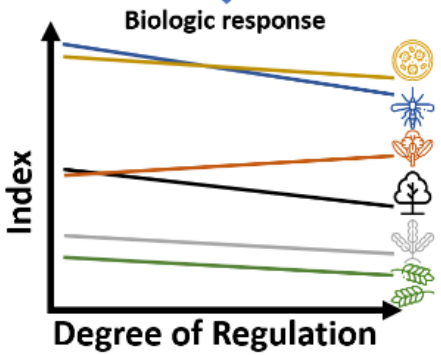
Riparian and aquatic functional changes

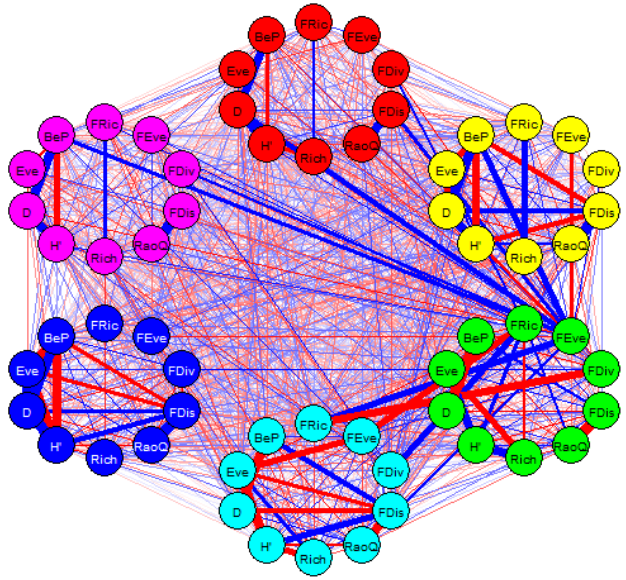






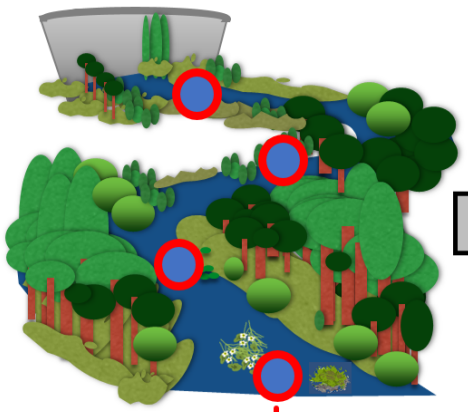
Biological & Functional Diversity indices

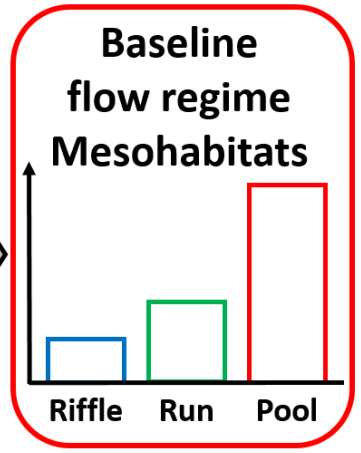




RIVEAL

Climate change vs. flow regime effects

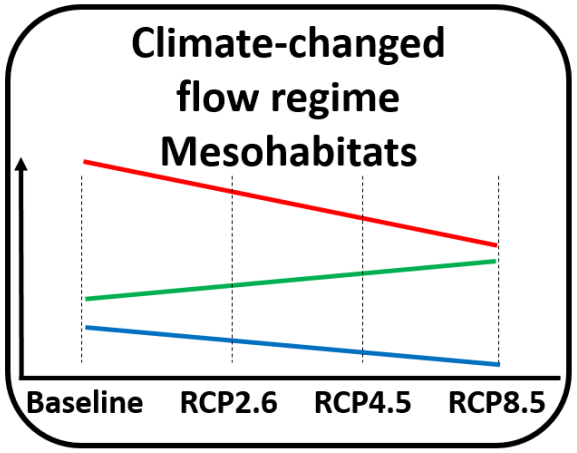


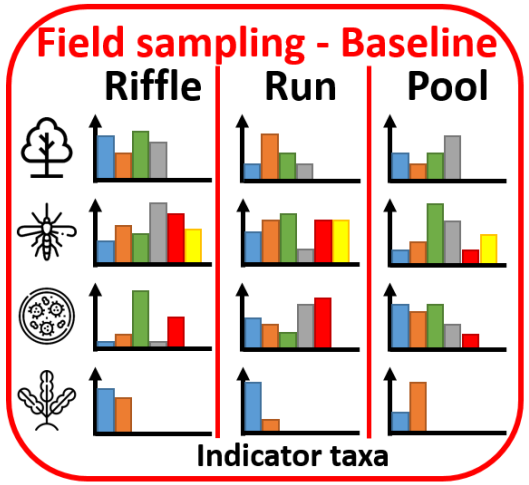


Climate change

Flow regime

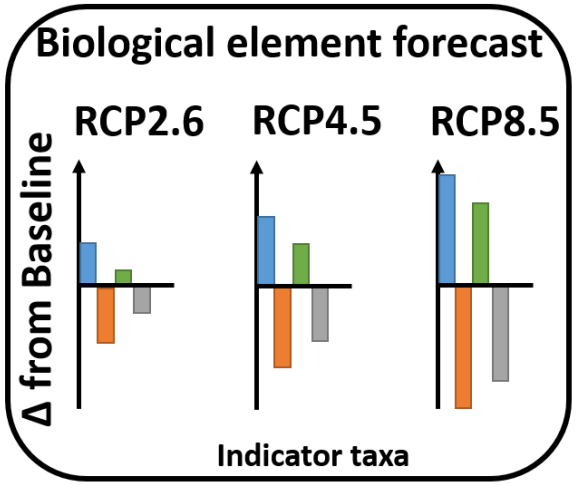
Hydraulic modeling





Climate change effects on multiple biological elements in regulated rivers

Referential



RIVEAL
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River ecosystem endangerment from climate change-driven regulated flow regimes

Rui Pedro Rivaes [a,*], Maria João Feio [b], Salomé F.P. Almeida [c], Ana R. Calapez [b], Manuela Sales [c], Daniel Gebler [d], Ivana Lozanovska [a], Francisca C. Aguiar [a]

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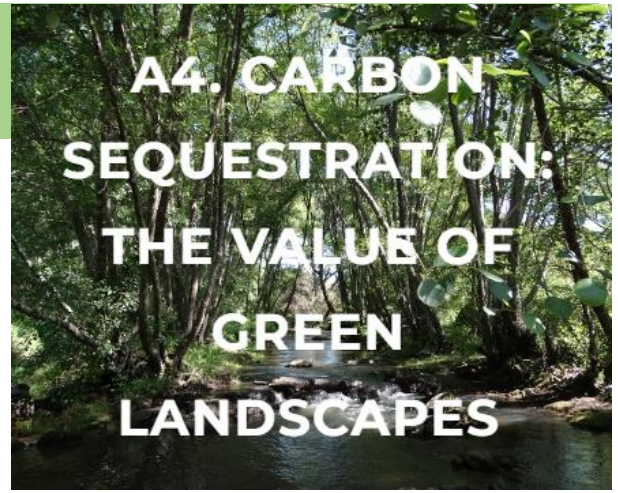
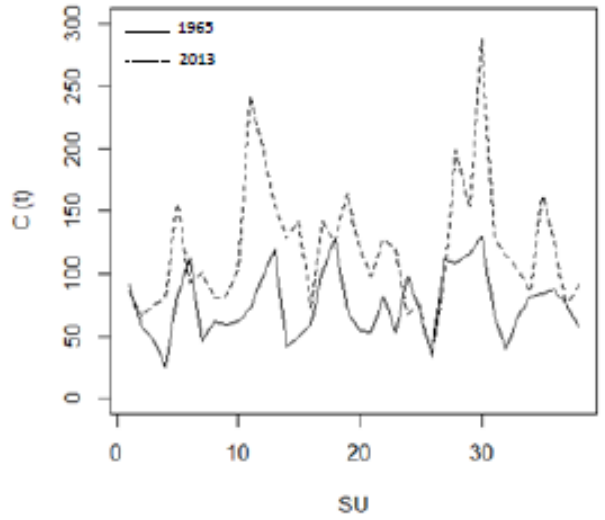
A4 The value of GREEN LANDSCAPES

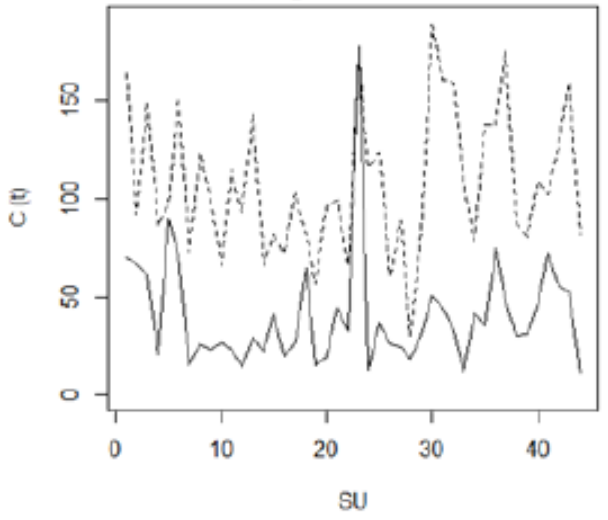


Total Carbon storage changes

Touvedo: run-of-river dam
(Lima River)
Low alteration:



Fronhas: storage dam
(Alva River)
High alteration:



ongoing

- **Overall increase of the total carbon stocks after hydrological regulation, in both study areas**
- Riverine areas located downstream of Touvedo (the run-of-river dam) exhibited **2.85 MtC in the pre-dam** and **4.56 MtC after hydrological regulation**
- The highest rise in the carbon storage: **Fronhas - storage reservoir dam:** total C in pre-dam =**1.79Mt C to total C post-dam= 4.74Mt C**)

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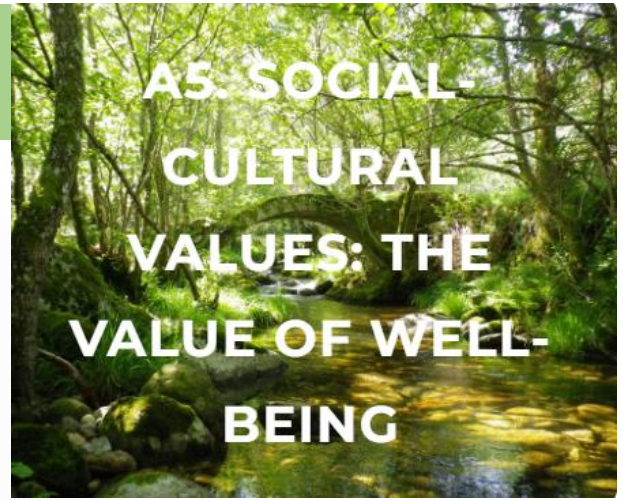
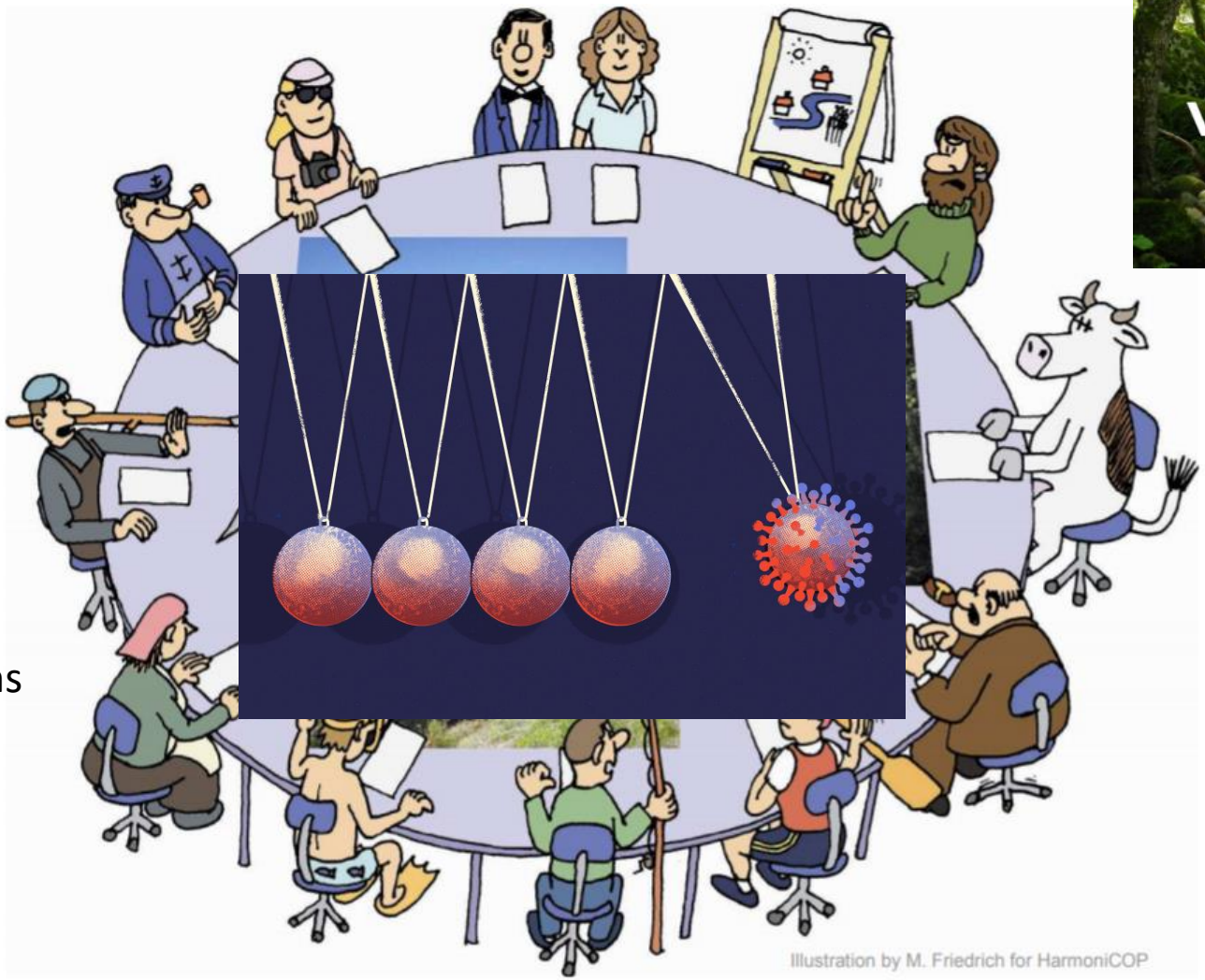
A5 The value of WELL-BEING



CULTURAL VALUES

Surveys, workshops, participatory research actions

ongoing

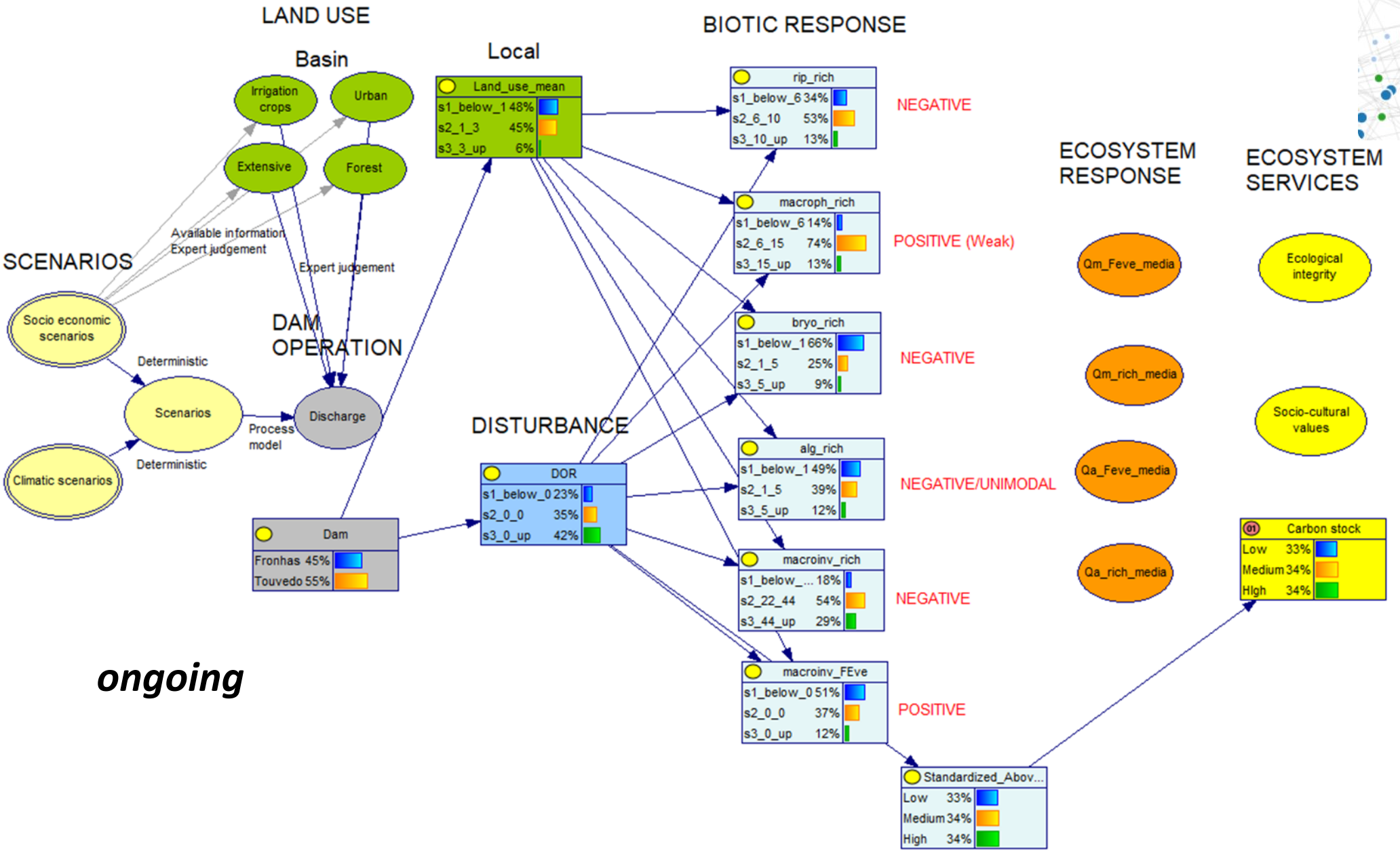


RIVEAL

A6

BAYESIAN MODELS

A6. RIVEAL-ES: DEVELOPMENT OF BAYESIAN MODELS



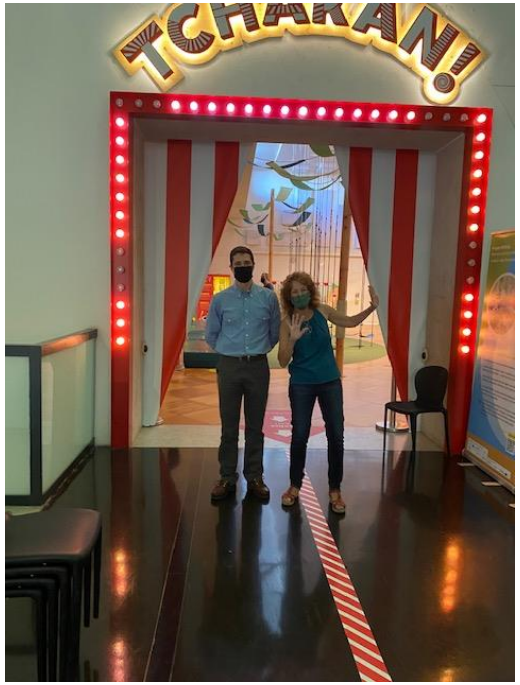
ongoing

RIVEAL

A7 Knowledge transfer

FACTSHEETS https://riveal.pt/results/fact-sheets/

WEBSITE https://www.riveal.pt




RIVEAL Factsheet #10
RIPARIAN FORESTS

RIVEAL PROJECT

RIPARIAN FOREST VALUES AND ECOSYSTEM SERVICES – RIPARIAN FORESTS

RIPARIAN FORESTS ARE...

... woody plant communities of semi-terrestrial habitats between terrestrial and aquatic ecosystems of rivers and streams and other inland waters, such as wetlands. Under the canopies many herbaceous plants thrive, profiting from the climatic regulation of riparian forests (on wind, light, and temperature) and the flow of nutrients and organic matter.

They are amongst the most diverse, complex and dynamic ecosystems worldwide. They may be naturally dominated by single woody species, e.g. alder woodlands, by shrubby communities on headwaters or by diverse interconnected vegetation units. In perennial rivers they frequently present a clear tranversal zonation from the aquatic ecosystem to the uplands, underlying communities with varying vertical strata and diverse requirements of soil humidity.

Riparian shrublands of Rubaceae tinctoria and Nerium oleander, River Guadiana, SE Portugal

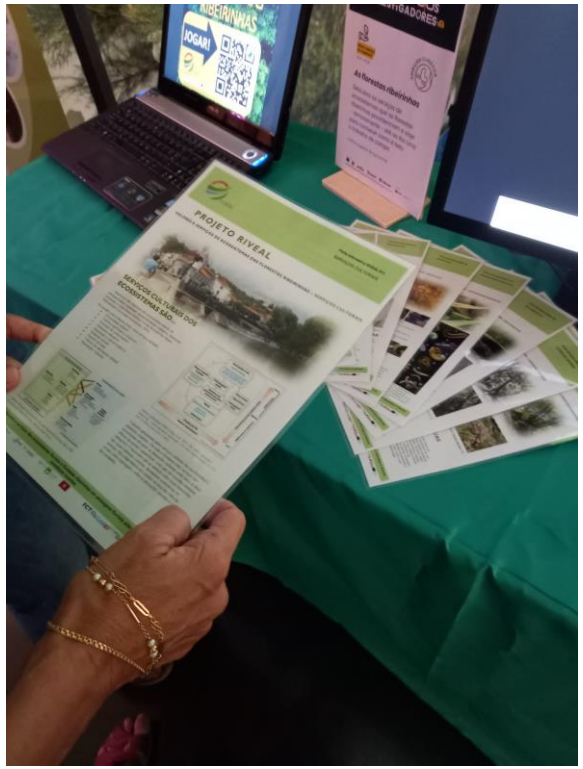
WHAT ARE THEIR FUNCTIONS?

Riparian forests are chief components for the riverine and aquatic environment and their biotic communities (such as riparian and aquatic plants, fish and macroinvertebrates).

They provide climatic regulation, habitat, spawning, and nursery areas, and as primary producers they participate in food webs. They offer refugia and migration corridors for birds, mammals and other animals. It is well-known their buffer capacity for pollutants and nutrients from agricultural runoff and the interaction in erosion and siltation processes.

Alder woodlands in River Rabaçal, Douro catchment, NE Portugal

RIVEAL: Riparian forest Values and Ecosystem services in uncertain freshwater futures and Altered Landscapes



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Wrap-up

- **Regulation** induced an **increase in riparian cover** and changes in riparian composition; diverse aquatic and riparian guilds respond differently to regulation
- **Different regulation types** resulted in **different impacts and different location and composition and functional traits of riparian plant communities and aquatic biota**
- **The Riparian cover, spatial and compositional changes are translated in gains and losses of Ecosystem Services**, for instance Carbon storage and sequestration is higher in hydropower rivers, but there is likely a substantial loss of diversity and habitats for flora and fauna
- Diverse perceptions of services with gender, education and type of regulation in relation to CES
- **More research** on assessment and valuation of ecosystem services and its inclusion on decision-making is needed in hydropower rivers

fraguiar@isa.ulisboa.pt

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For more information visit the project website!

Funding: