

# Hydromorphological evolution of large Iberian rivers: the role of anthropogenic pressure in Tagus and Minho Rivers

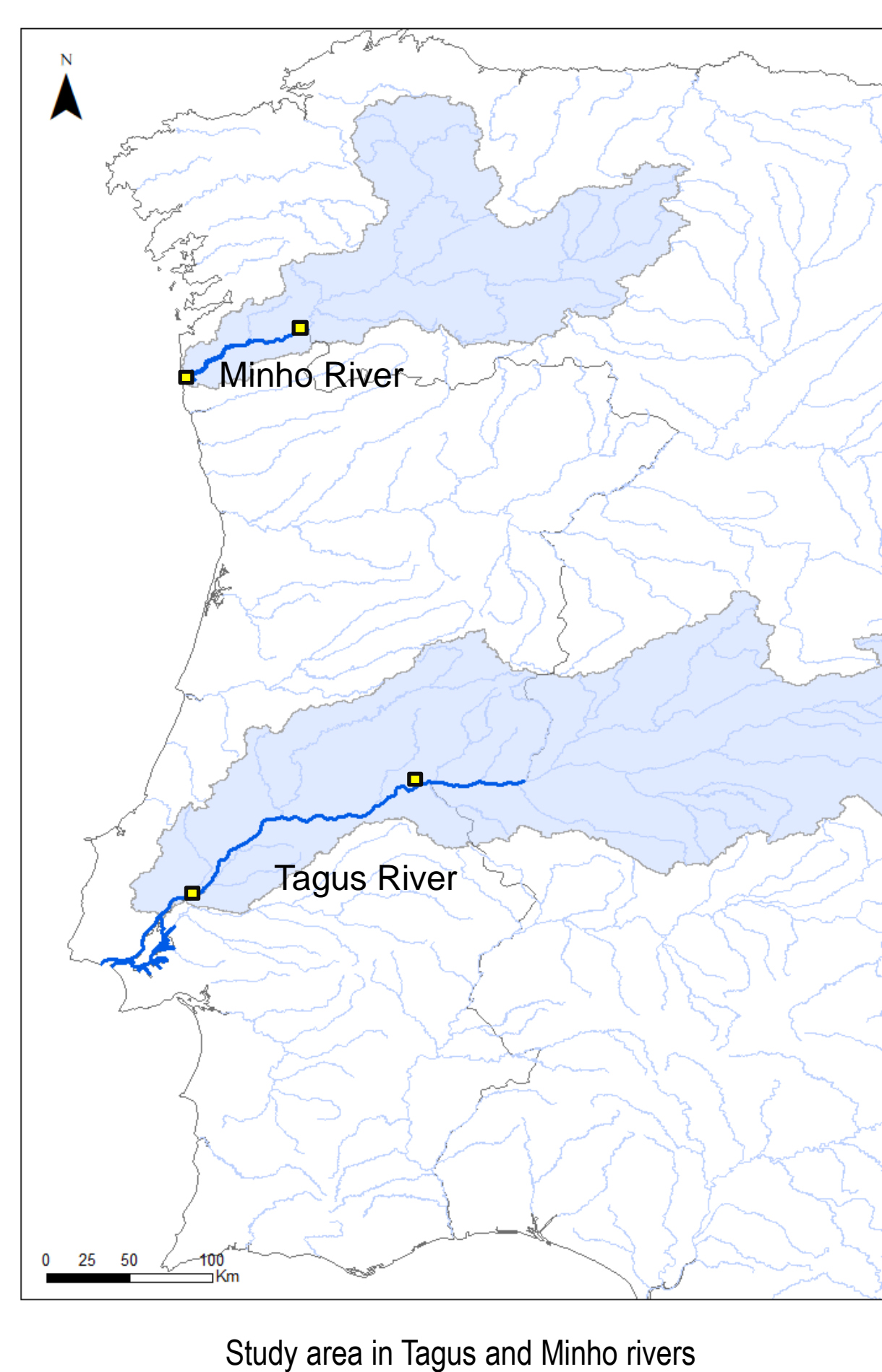
Évolution hydromorphologique des fleuves ibériques: le rôle de la pression anthropique dans les grandes rivières Tage et Minho

## Aim

Characterize the hydromorphological evolution of Tagus and Minho rivers in a context of hydrological alteration and LULC changes

Assess the magnitude and trajectory of hydromorphological changes in distinct river zones

## Methods



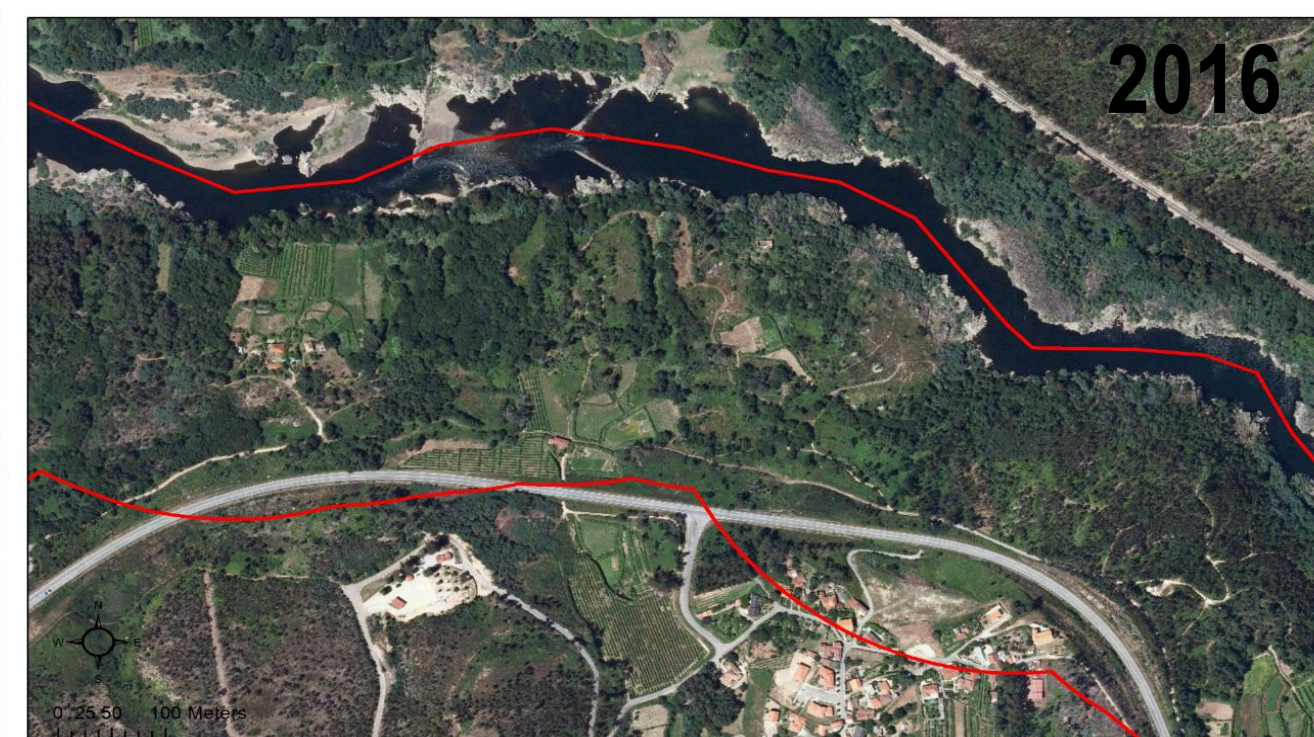
**Study area:**  
88 km in Minho and 128km in Tagus River

Several dams along Minho and Tagus River mainly constructed in 1950 and 1970.

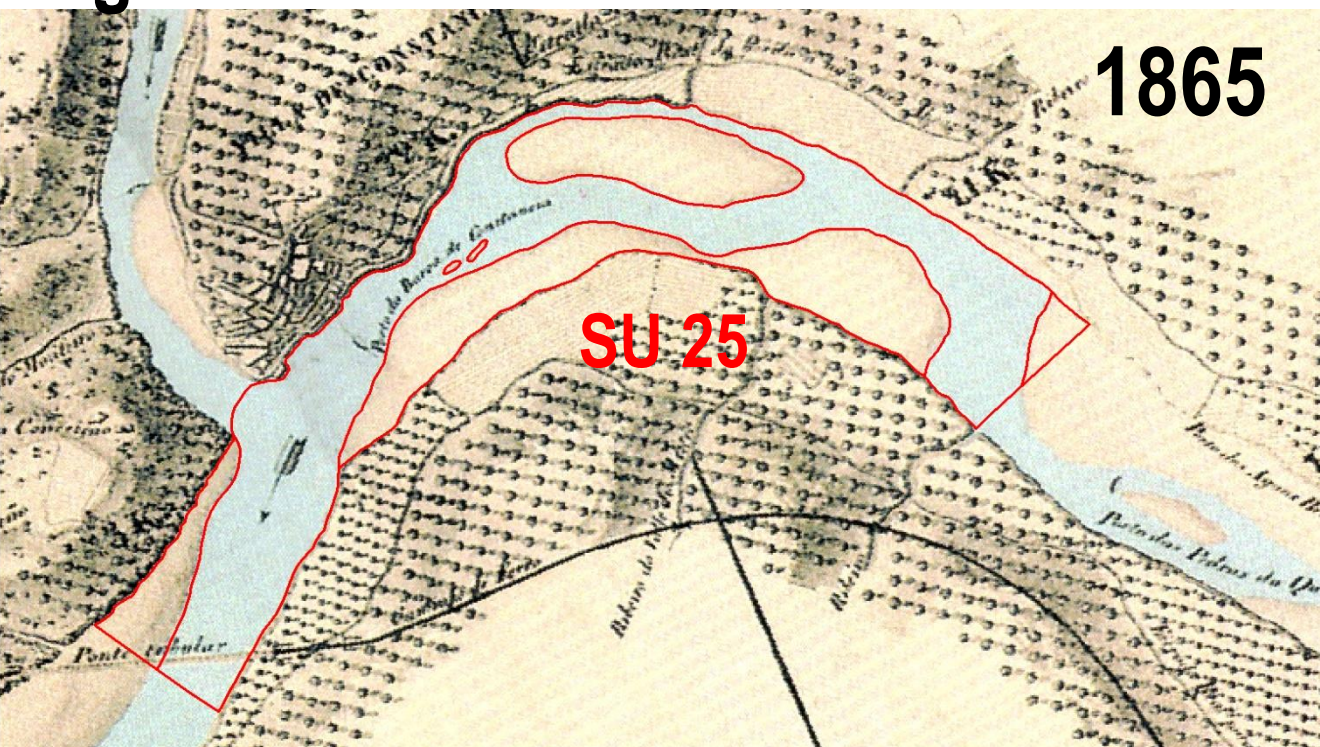
### Temporal analysis

- Historical data (Pre-regulation - 19th century)
- Contemporaneous data (Post-regulation – 21th century)

### Minho River



### Tagus River



## Sampling design

Georeferenciation of historical maps using ground control points

Delimitation of sampling units (SU): 2500m long river stretches

Hydromorphological feature extraction by image analysis

Hydrological and Land-use Land-cover change assessment

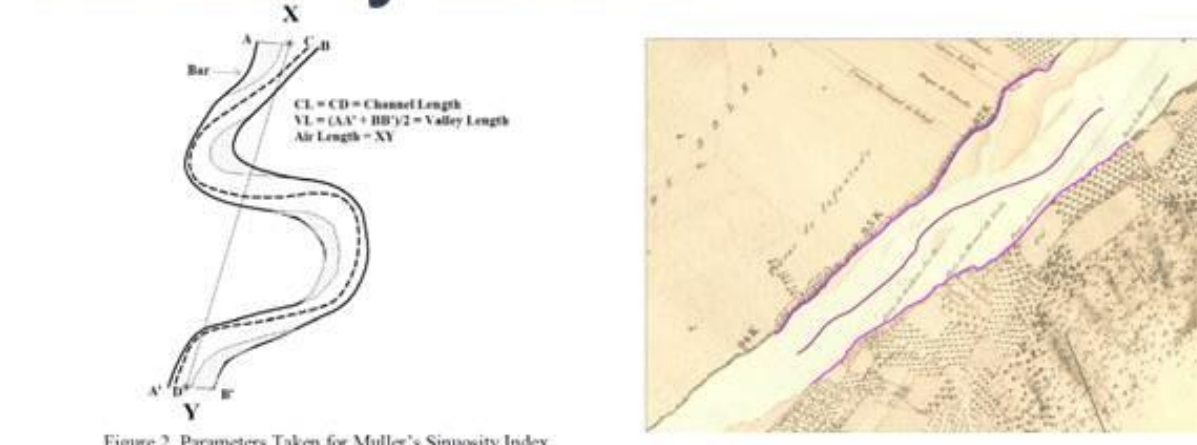
**Hydrological data:** Portuguese and Spanish Water Information System for the contemporaneous data and modelled for the historical period using Soil and Water Assessment Tool software.

**Land-use Land Cover (LULC) data:** mapped in a 200m-buffer, by visual interpretation of the historical maps and using CQS 2007 for the contemporaneous data.

## Hydromorphological metrics

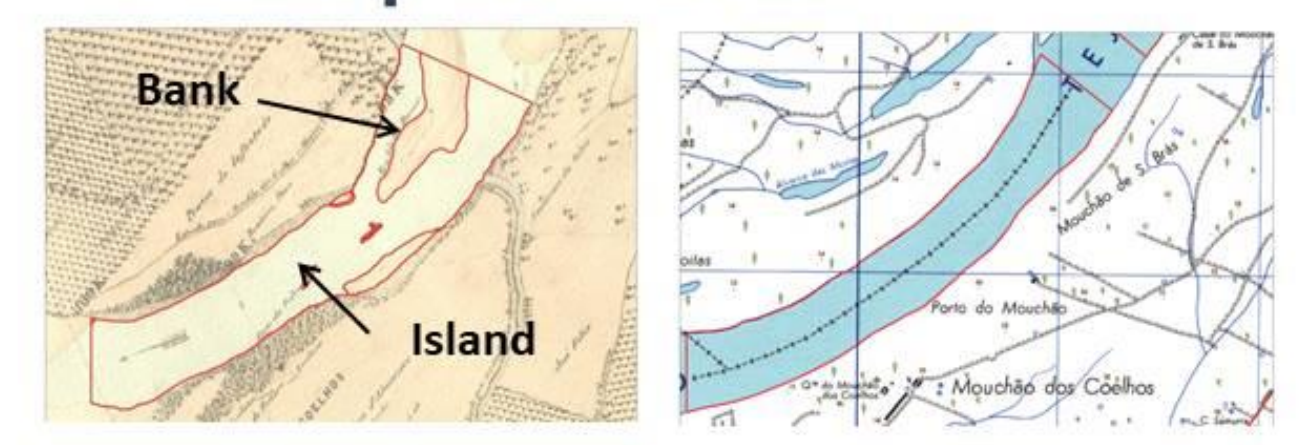
Calculated for the 35 SU's of Minho and 55 SU's of Tagus for the historical and contemporaneous data

### Sinuosity metrics



River meandering and flow capacity

### Geomorphic metrics



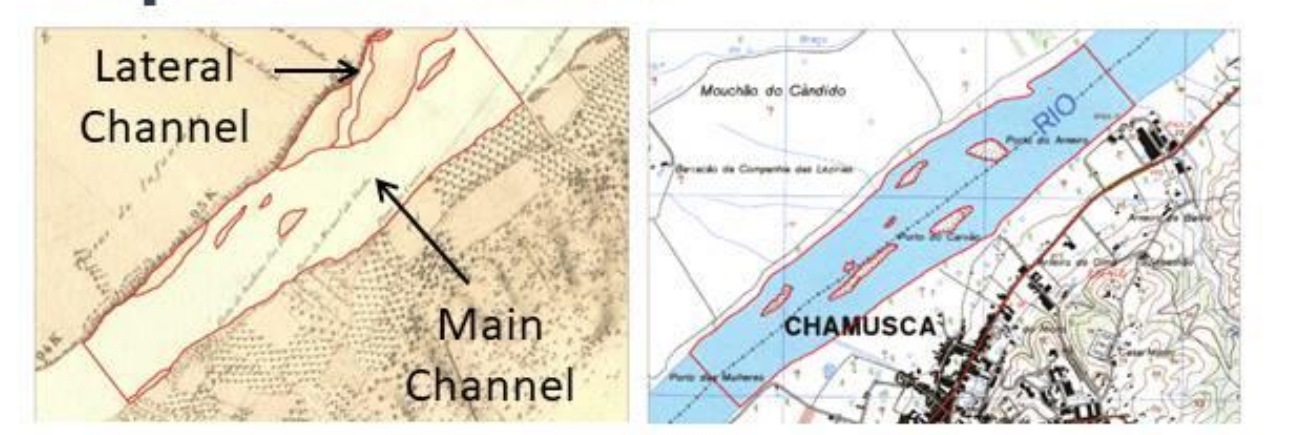
Instream habitat diversity and river mobility

### Riparian metrics



Lateral connectivity with the floodplain, Ecosystem functions

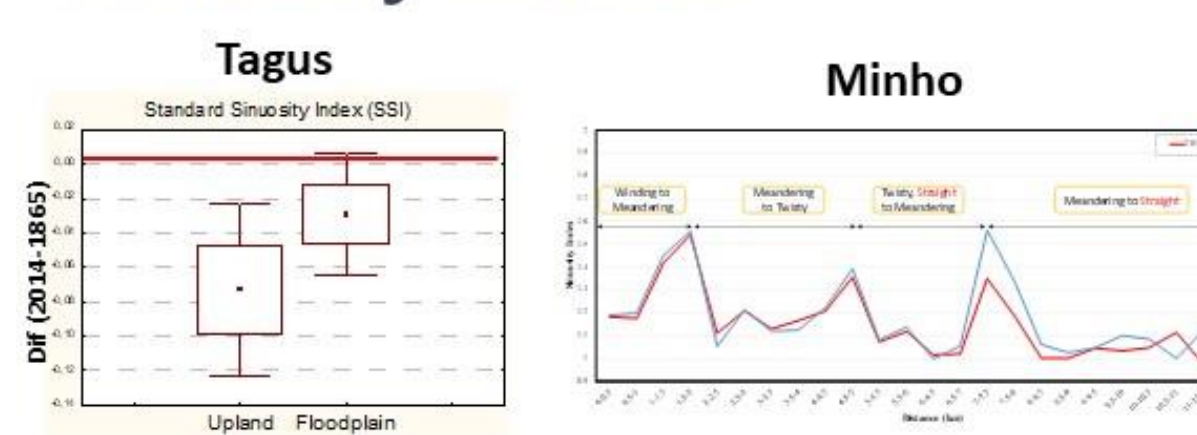
### Aquatic metrics



Channel capacity, Habitat diversity and lateral hydrological connectivity

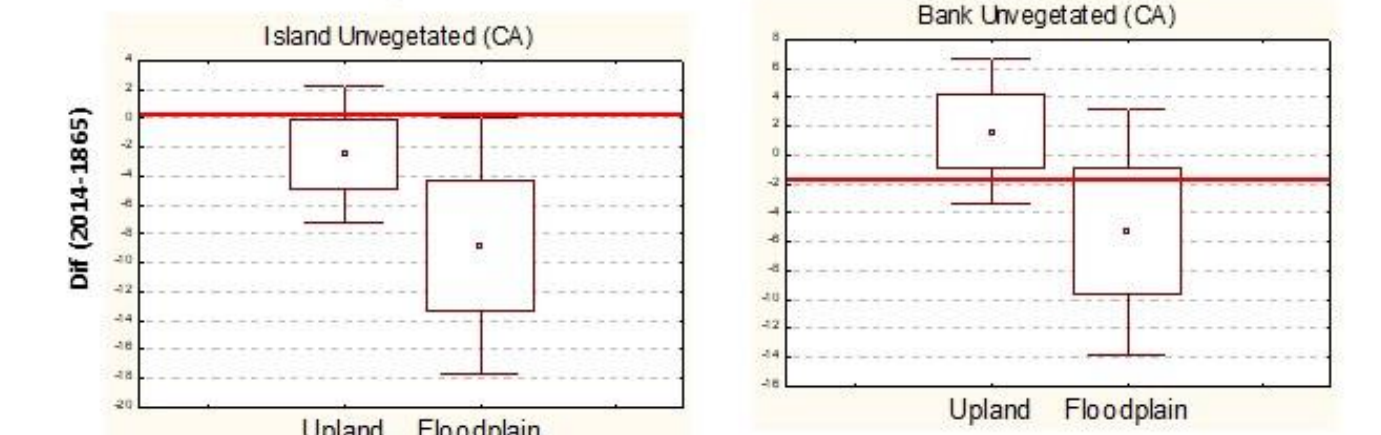
## Results

### Sinuosity metrics



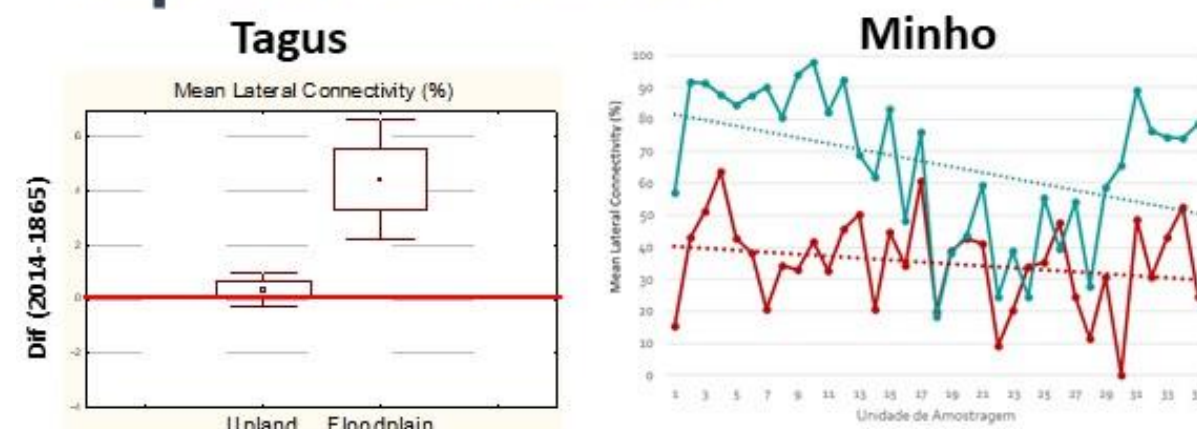
Decrease in Sinuosity with higher expression in the Upland zone of Tagus and in Floodplain zone of Minho

### Geomorphic metrics



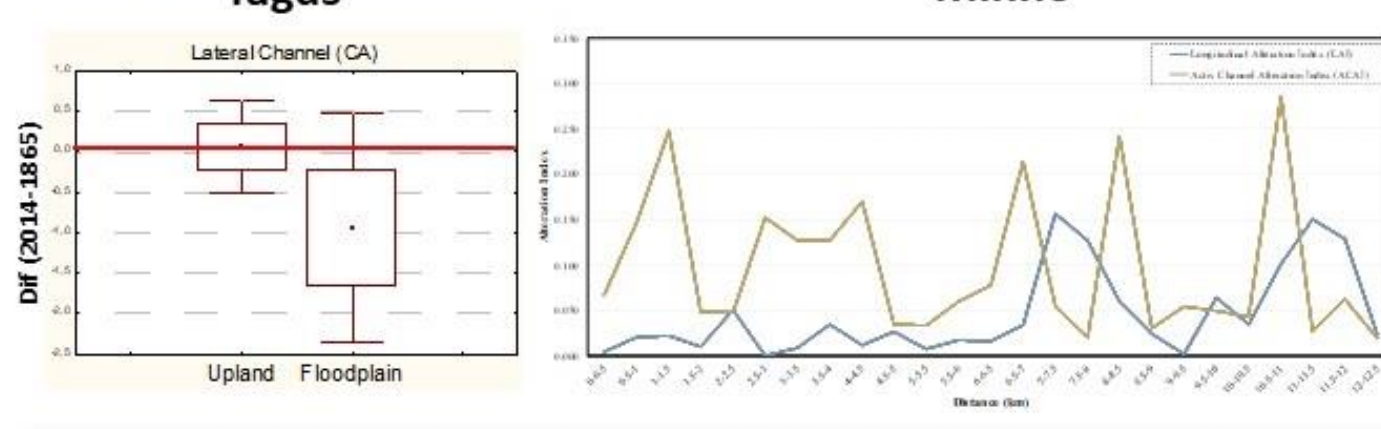
Reduction in the total area occupied by Islands and Banks, mainly in Floodplain zone of Tagus. \* Not available for Minho River

### Riparian metrics



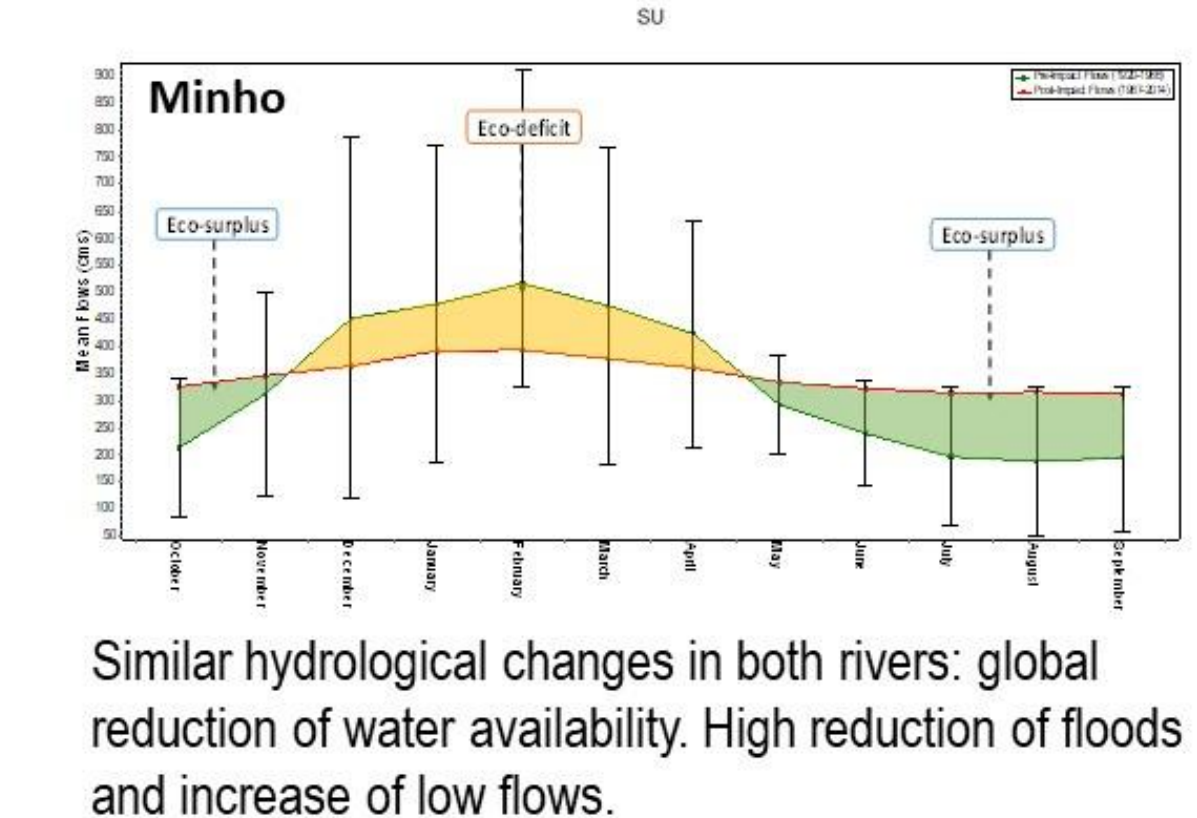
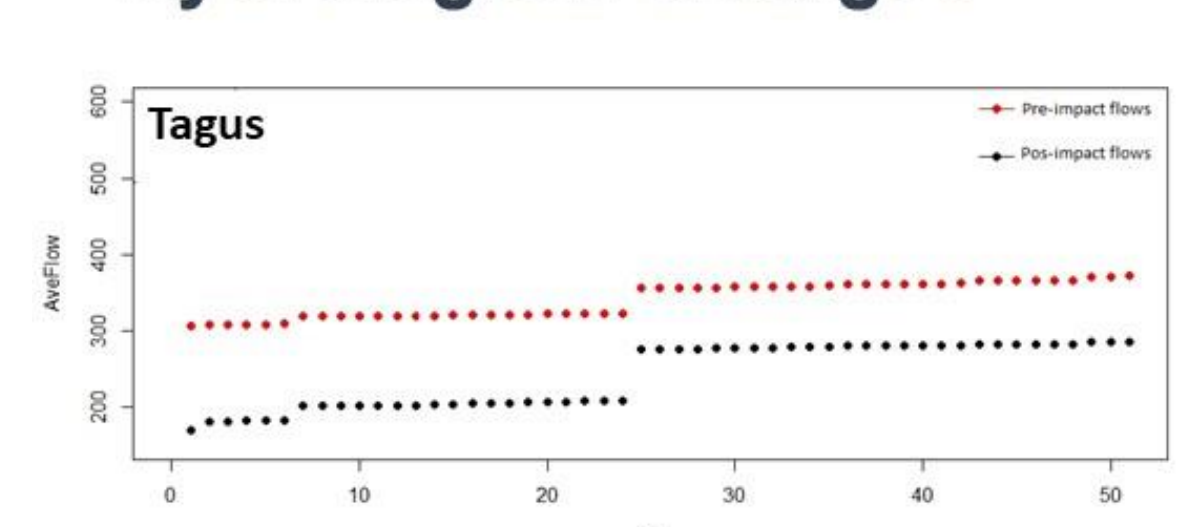
Increase of the Riparian Lateral Connectivity in both rivers, especially evident in Floodplain of Tagus and in Upland of Minho

### Aquatic metrics



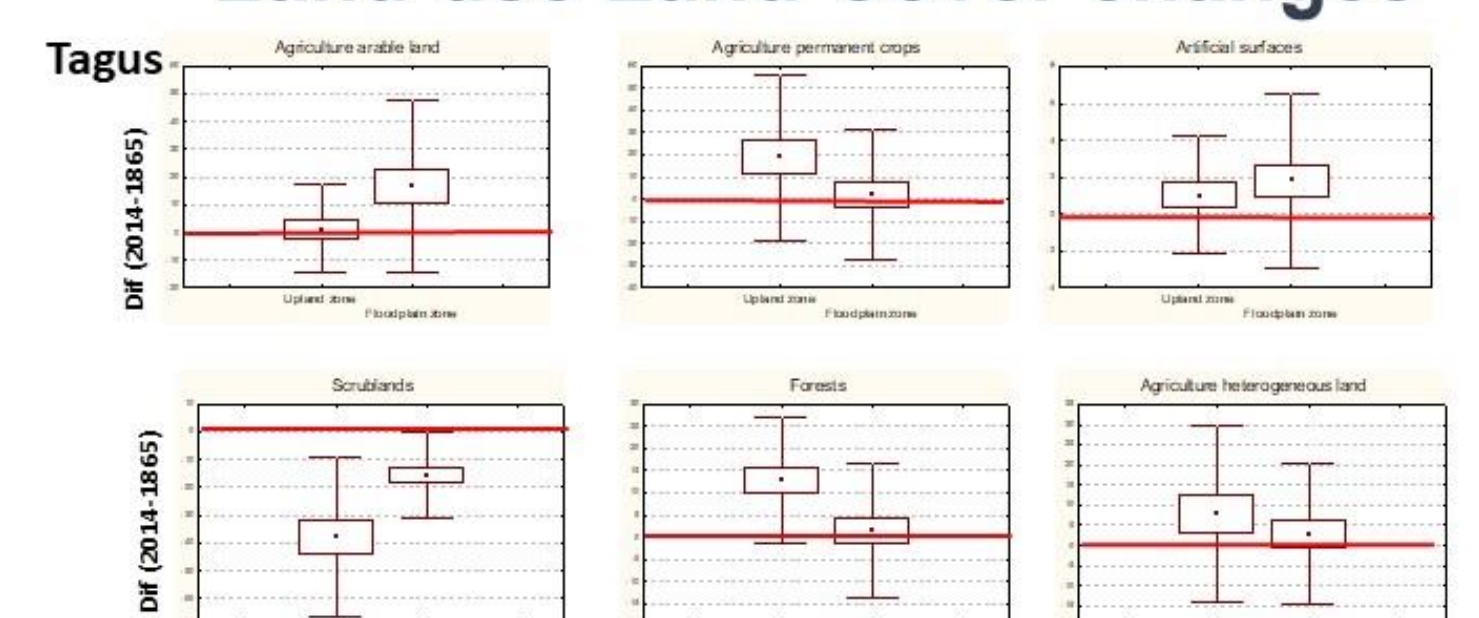
Decrease in Lateral Channels, especially in Floodplain zone of Tagus. In Minho, Active Channel reveals high alteration along the whole river, while Longitudinal Alteration is more evident in Floodplain zone

### Hydrological changes



Similar hydrological changes in both rivers: global reduction of water availability. High reduction of floods and increase of low flows.

### Land-use Land-Cover changes



Reduction of natural land-uses in both rivers. but.... LULC changes depend on river position combined with peculiar socio-economic forces.

## Conclusions

Tagus and Minho rivers showed significant hydromorphological changes over the last century.

Tagus morphological degradation was more evident, and was particularly relevant in Upland zone, while Minho was mostly impaired in downstream sections.

Hydromorphological changes were driven by a combined effect of hydrological alterations and LULC changes acting at local level.

Historical cartography can be used to assess the evolutionary trajectory of changes in large Iberian rivers.

M. Rosário Fernandes<sup>1\*</sup>, Francisca C. Aguiar<sup>1\*\*</sup>, M. João Martins<sup>1</sup>, Rui Rivaes<sup>1</sup>, Alban Kuriqi<sup>2</sup>, M. Teresa Ferreira<sup>1</sup>

<sup>1</sup> Forest Research Centre (CEF), School of Agriculture, University of Lisbon, Tapada da Ajuda, 1349-017 Lisboa, Portugal

<sup>2</sup> Centre for Hydrosystems Research (CEHIDRO), Instituto Superior Técnico, University of Lisbon, Av. Rovisco Pais, 1049-001 Lisboa, Portugal

\* (corresponding author: [mfernandes@isa.ulisboa.pt](mailto:mfernandes@isa.ulisboa.pt)), \*\* Presenting author