EFFECTS OF HYDROLOGICAL ALTERATIONS IN THE RIPARIAN CARBON STOCK CAPACITY: UNDERSTANDING THE PAST TO PREDICT THE FUTURE

M.R. FERNANDES [1], A. CORREIA [1], M.J. MARTINS [1], R. RIVAES [1], M.T. FERREIRA [1] and F.C. AGUIAR

1. Forest Research Centre (CEF), School of Agriculture, University of Lisbon, Portugal

INTRODUCTION

Riparian forests provide numerous ecosystem services, including climate regulation service

⬇

HIGH BIOMASS PRODUCTION

⬇

CARBON SINKS

⬇

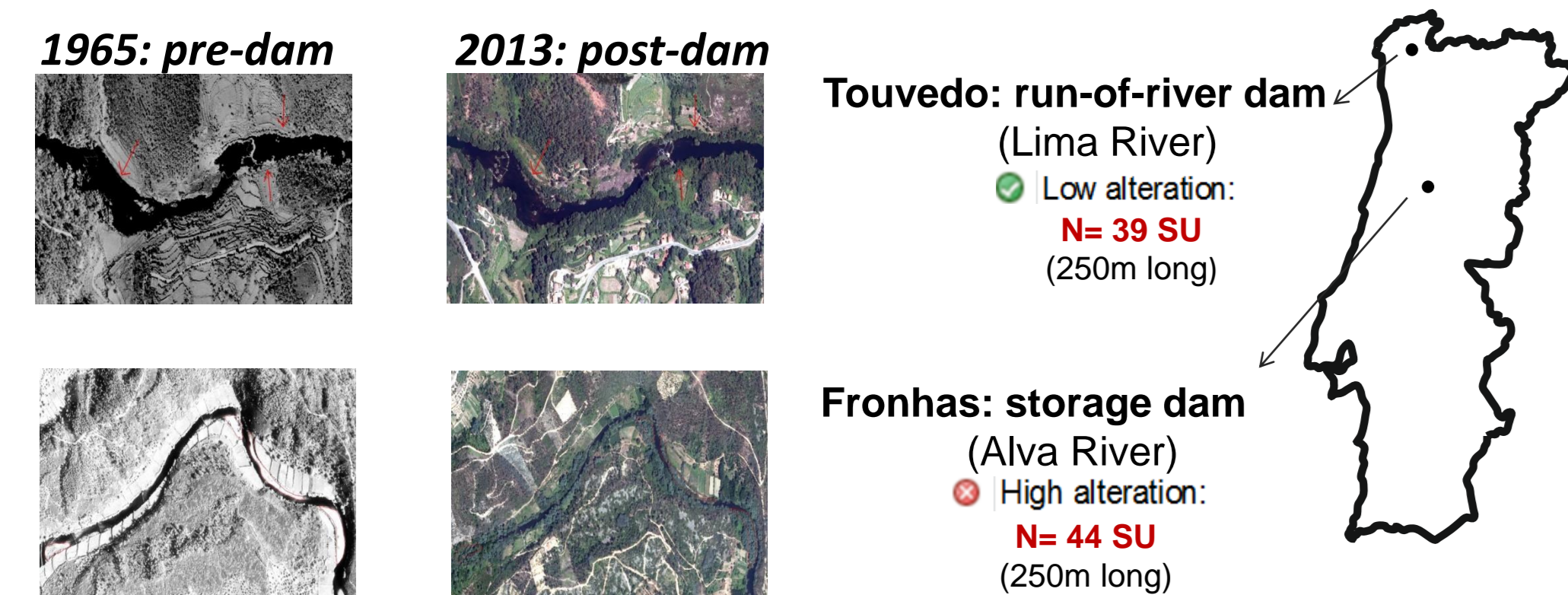**Crucial systems to mitigate the effects of climate change**

AIM

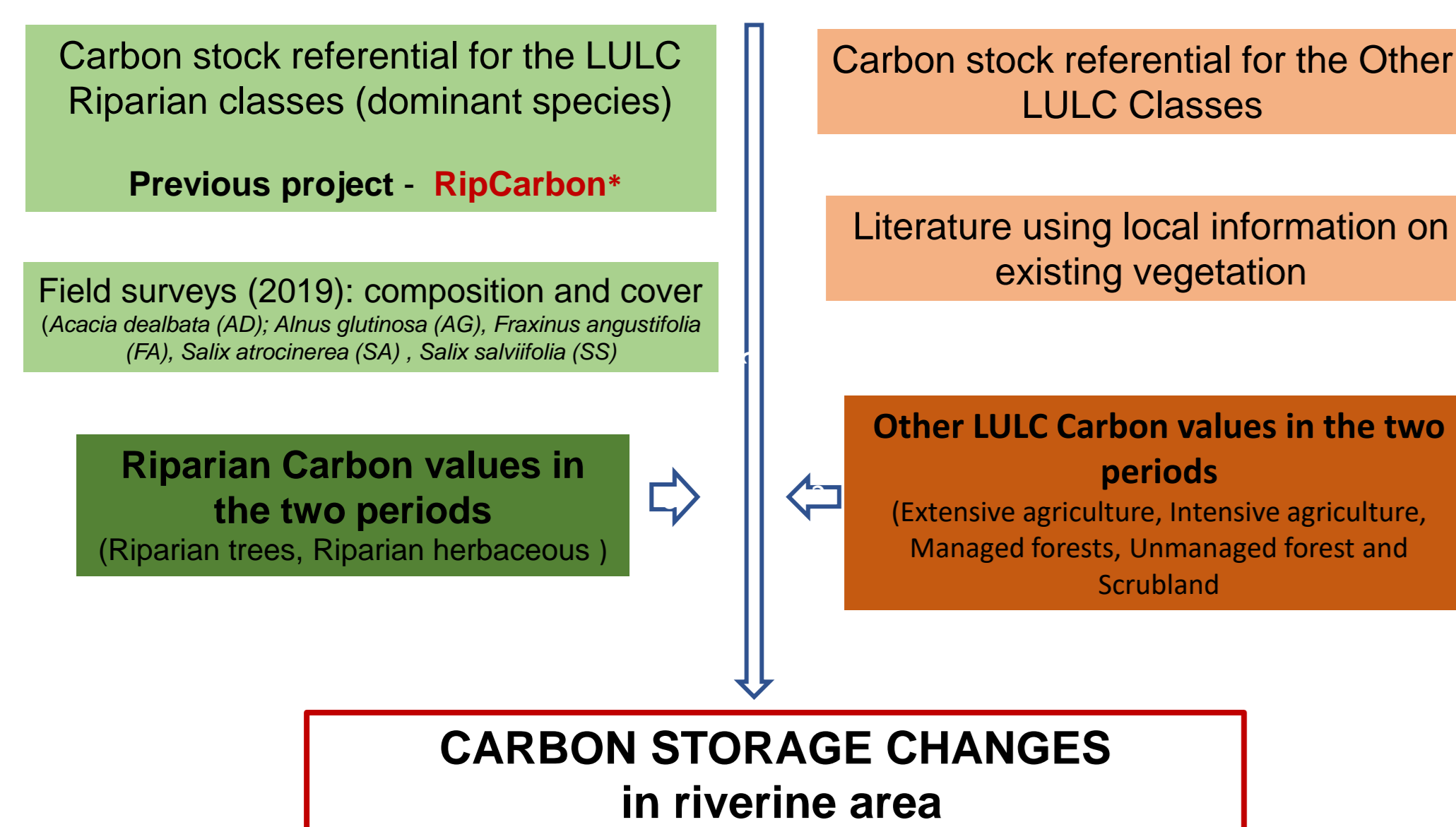Estimate **the carbon stock changes** of riverine areas under flow regulation

Assess the **effects of hydrological regulation** in the carbon storage Ecosystem Service

METHOD

Temporal comparison: Land-use Land-cover (LULC) approach

1965: pre-dam *2013: post-dam*

Touvedo: run-of-river dam
(Lima River)
✅ Low alteration:
N= 39 SU
(250m long)

Fronhas: storage dam
(Alva River)
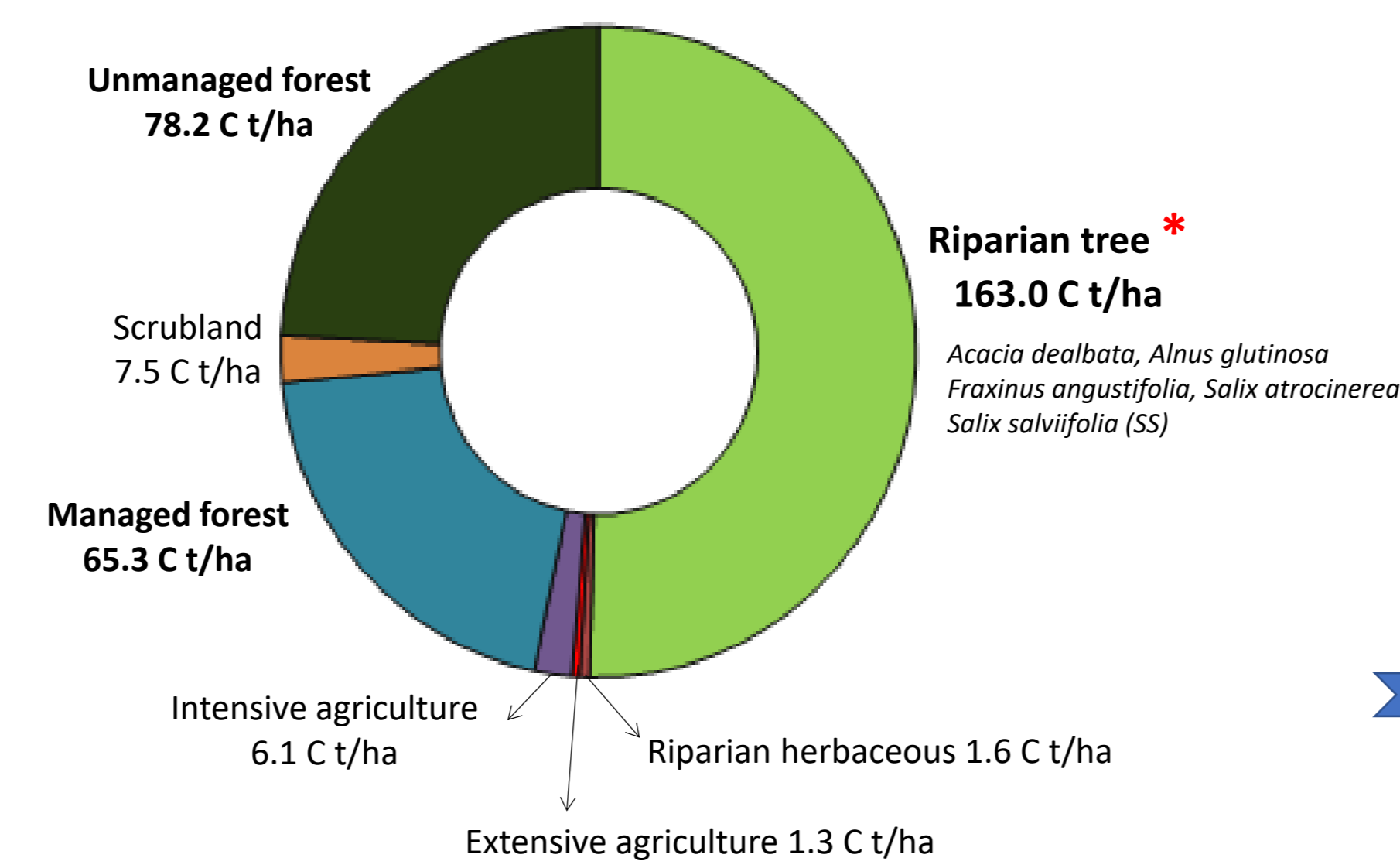❌ High alteration:
N= 44 SU
(250m long)

LULC maps in the Riverine area (100-year flood) : **Riparian classes** (Riparian trees, Riparian herbaceous) and **Other LULC classes** (Extensive agriculture, Intensive agriculture, Managed forests, Unmanaged forest and Scrubland

Carbon stock referential for the LULC Riparian classes (dominant species)

Previous project - RipCarbon*

Field surveys (2019): composition and cover
(*Acacia dealbata* (AD); *Alnus glutinosa* (AG), *Fraxinus angustifolia* (FA), *Salix atrocinerea* (SA) , *Salix salviifolia* (SS))

Carbon stock referential for the Other LULC Classes

Literature using local information on existing vegetation

Other LULC Carbon values in the two periods
(Extensive agriculture, Intensive agriculture, Managed forests, Unmanaged forest and Scrubland

Riparian Carbon values in the two periods
(Riparian trees, Riparian herbaceous)

CARBON STORAGE CHANGES in riverine area

RESULTS

Carbon referential per LULC class (c t/ha)

- Unmanaged forest **78.2 C t/ha**
- Scrubland 7.5 C t/ha
- Managed forest **65.3 C t/ha**
- Intensive agriculture 6.1 C t/ha
- Extensive agriculture 1.3 C t/ha
- Riparian herbaceous 1.6 C t/ha
- Riparian tree * **163.0 C t/ha** *Acacia dealbata, Alnus glutinosa Fraxinus angustifolia, Salix atrocinerea Salix salviifolia (SS)*

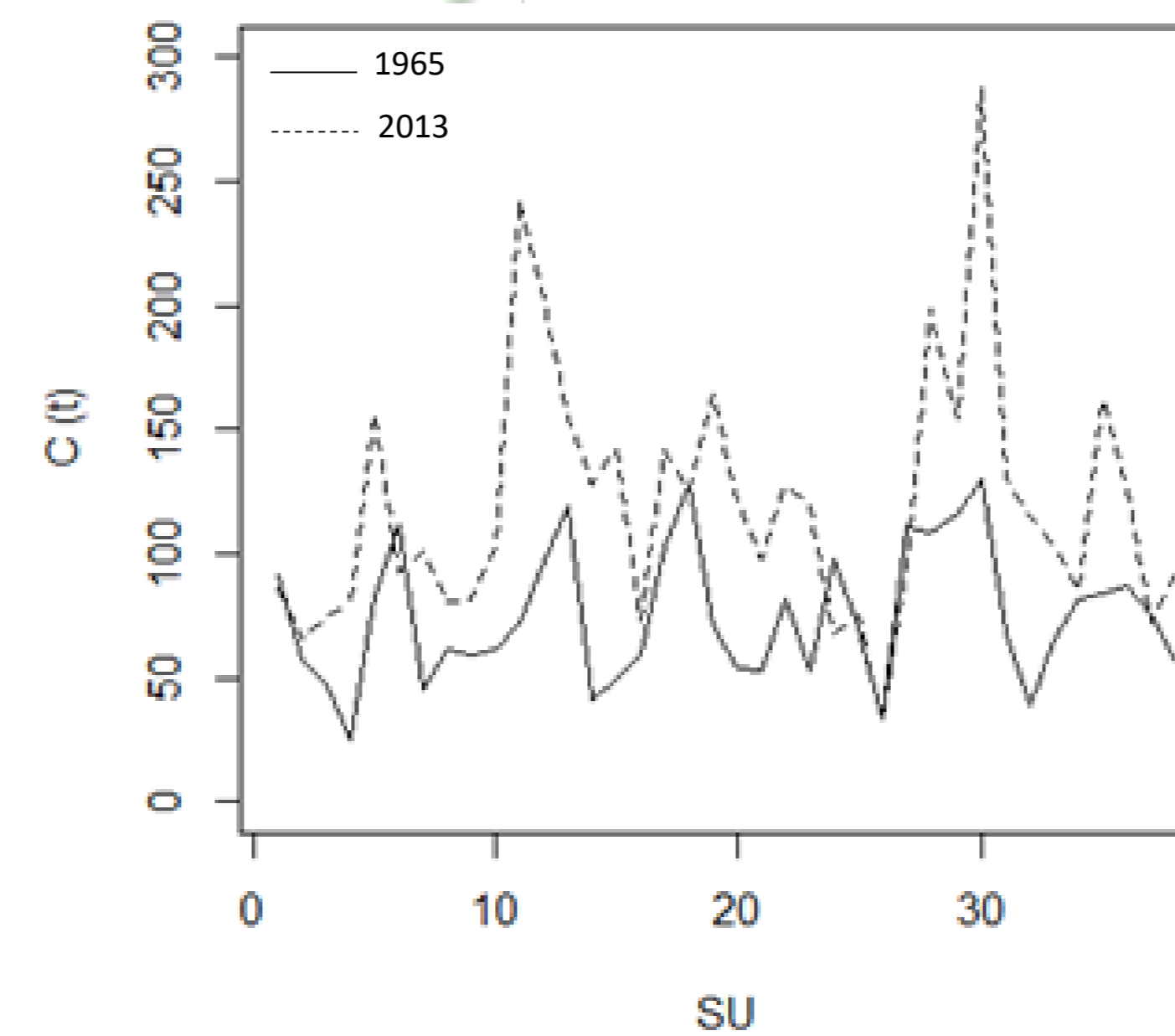* Derived from a previous project (RipCarbon) + field surveys

➤ The highest referential was achieved in the **Riparian tree class** fallowed by the Unmanned forest and then by managed forest.
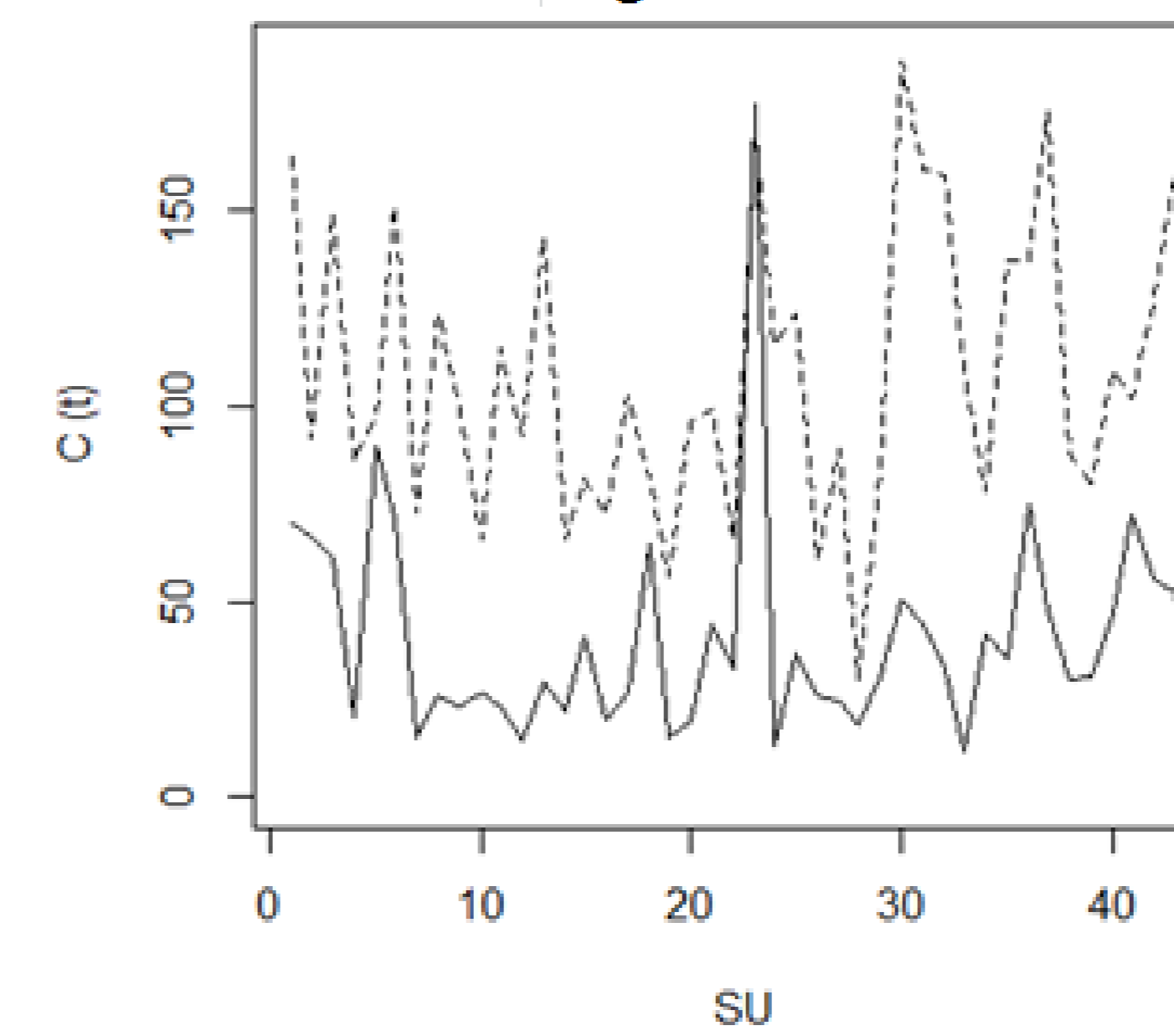
Total Carbon storage changes

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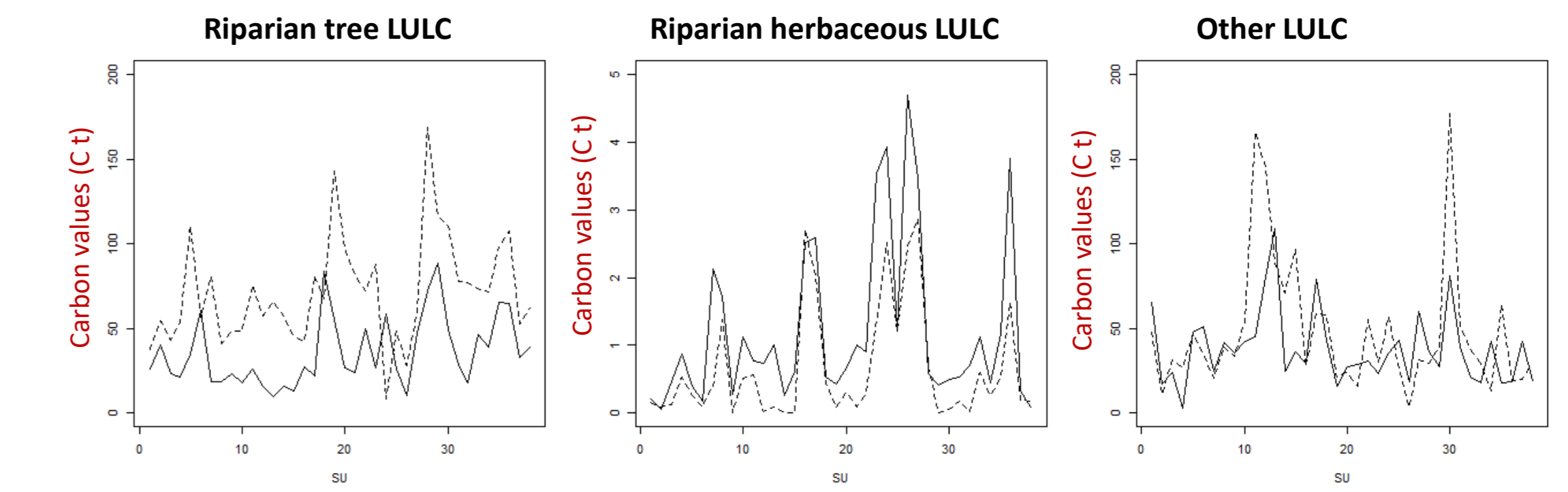✅ Low alteration:

**Fronhas: storage dam** (Alva River)
❌ High alteration:

➤ **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**)

Touvedo – Lima River ✅ Low alteration:

Riparian tree LULC | Riparian herbaceous LULC | Other LULC

➤ More **Riparian tree cover in the post-dam period** resulting from agricultural land abandonment in river margins

➤ Increase of the Unmanaged forests classes in the post-dam period

Fronhas- Alva River ❌ High alteration:

Riparian tree LULC | Riparian herbaceous LULC | Other LULC
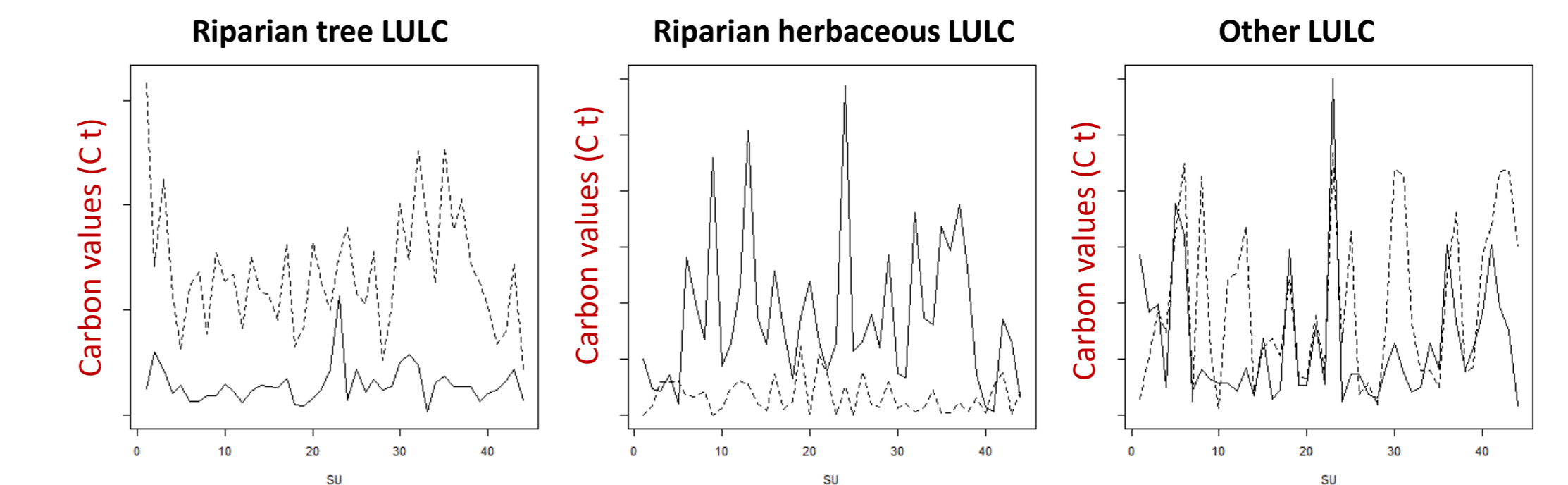
➤ **Marked riparian expansion in the post-dam period**

➤ Increase of Unmanaged forests in the post-dam period, especially with **new plantations of eucalyptus**.

CONCLUSIONS

➤ **Riparian carbon storage increase after hydrological regulation**.

➤ The differences on carbon stocks between case studies are related to changes in the species composition and the total cover of the LULC classes.

⬇ Intensive agriculture

⬆ Riparian tree
Managed forests
Unmanaged forests

➤ The **different hydrological disturbance**, imposed by the distinct dam operation schemes, led to **distinct contributions to carbon stocks changes in riverine areas**

REFERENCES

Fernandes MR, Aguiar FC, Martins MJ, Rico N, Ferreira MT, Correia AC. 2020. Carbon Stock Estimations in a Mediterranean Riparian Forest: A Case Study Combining Field Data and UAV Imagery. *Forests, 11 (4), 376:* https://doi.org/10.3390/f11040376

Aguiar FC, Martins MJ, Silva PC, Fernandes MR. 2016. Riparian landscapes downstream hydropower dams: effects of historical land-use change and altered flows. *Landscape and Urban Planning 153, 83-89.* https://doi.org/10.1016/j.landurbplan.2016.04.009

ACKNOWLEDGEMENTS

CONTACT INFORMATION

Maria do Rosário Pereira Fernandes, Centro de Estudos Florestais, Instituto Superior de Agronomia, Universidade de Lisboa

mrfernandes@isa.ulisboa.pt