Assessing remote and proximal sensing methods for estimating biophysical variables at different spatial resolutions

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1 Introduction

Accurate estimation of **structural** (e.g., LAI or f_{aPAR}) and **biochemical traits** (e.g., C_{ab} or C_N)

Problem

Lab methods are:
1. Costly and time-consuming
2. Sometimes destructive
3. Spatially limited

Challenge

To achieve the same accuracy at regional and global scales, efficiently, quickly and non-destructive

Vegetation traits can be inferred from spectral reflectance

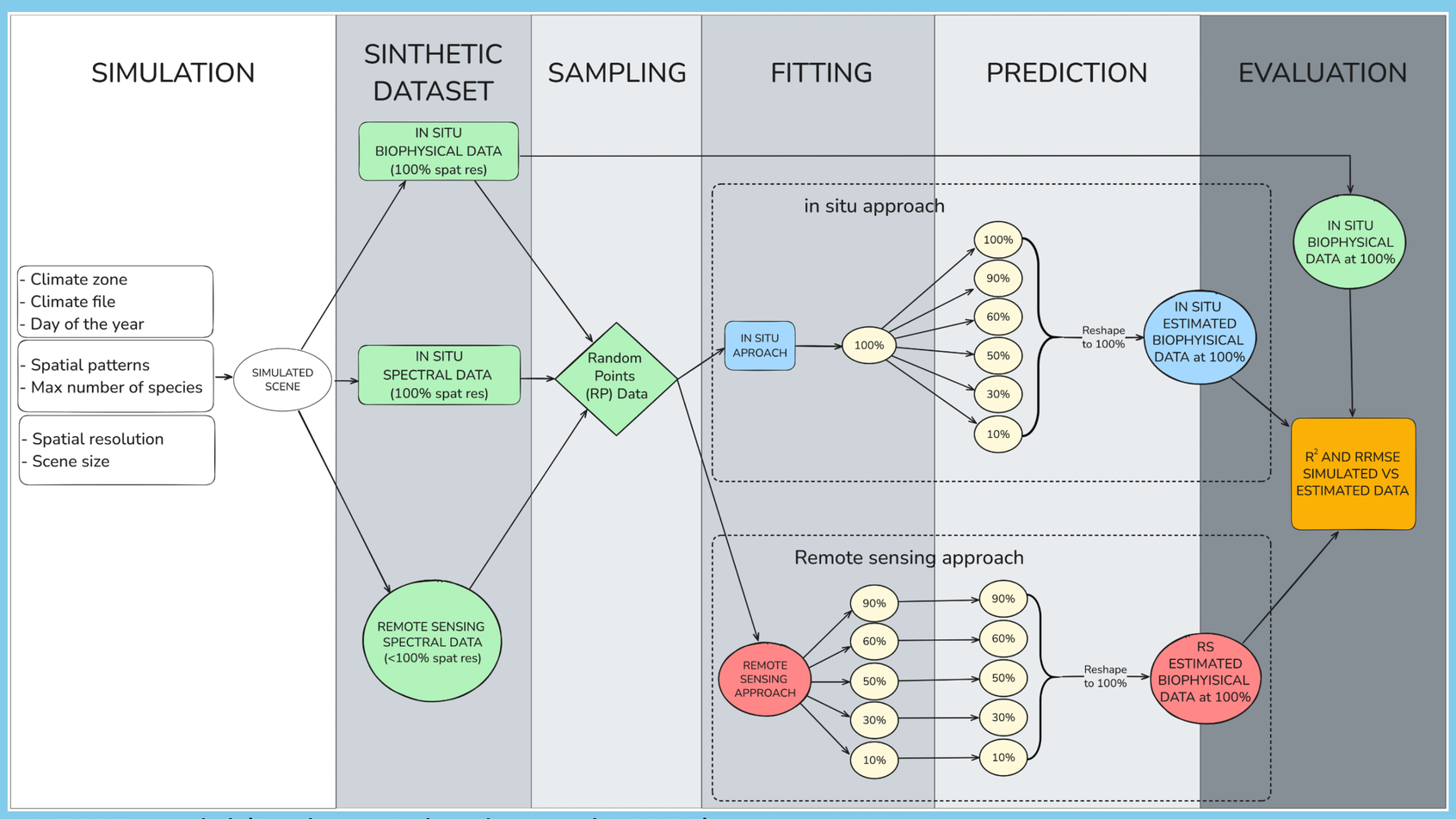
Remote Sensing enables estimation at different scales

Problem

- **Mismatch** between ***in situ*** and **RS data**
  1) Spectral 2)Temporal
  3) Spatial 4) Others: e.g., BRDF

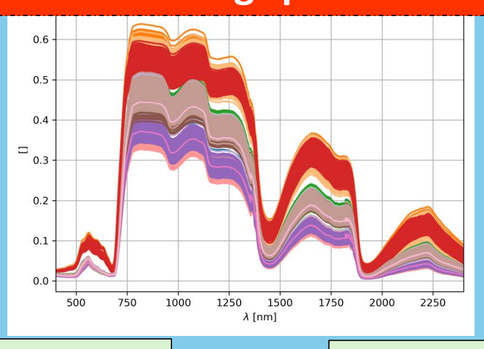
OBJECTIVE: To study methods for integrating remote and proximal sensing data across spatial scales with in situ measurements, enabling their application from regional to global scales

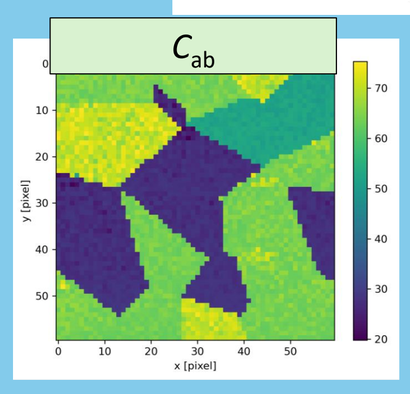
2 Methods

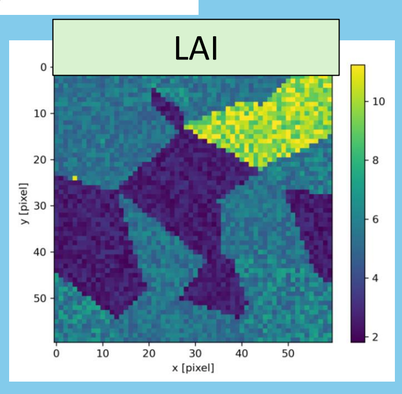


BOSSE Model (Pacheco-Labrador et al., 2025)

In situ biophysical synthetic data and synthetic remote sensing spectral data





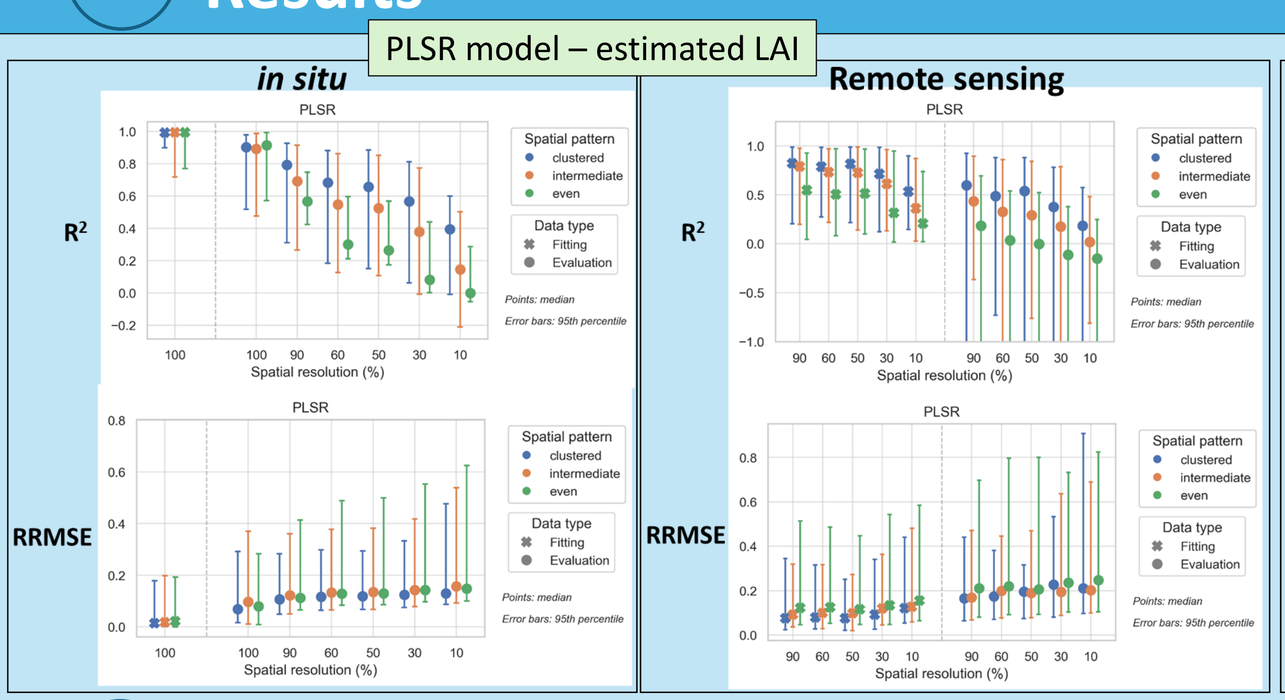


PLSR model and 2 Linear regression models (NDVI and NIRv) to estimate LAI and C_{ab}

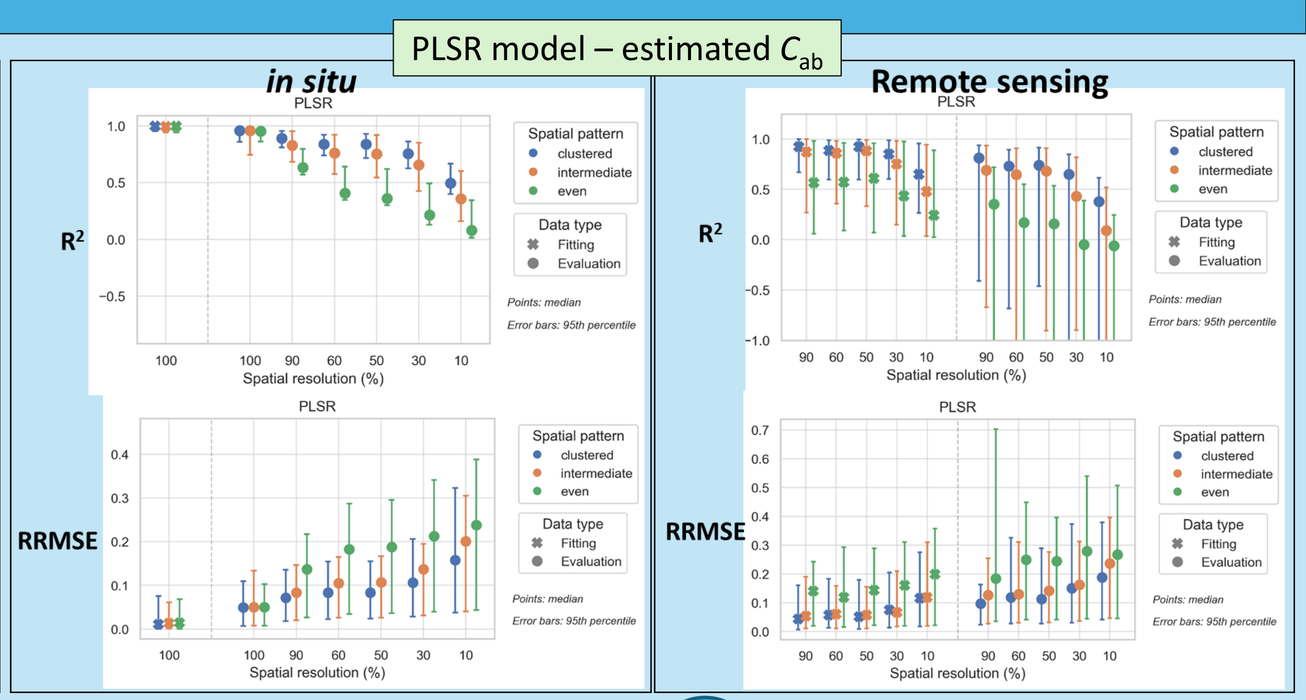
At different spatial resolutions

3 Results

PLSR model – estimated LAI



PLSR model – estimated C_{ab}



4 Conclusions

1. The PLSR model showed the lowest RRMSE values and the highest R^2 for both variables (LAI and C_{ab}). **2.** The PLSR performed better with in situ approach than with remote sensing approach. **3.** LAI saturation below 5 with Linear NDVI and poor correlation of C_{ab} with Linear NIRv. **4.** The spatial patterns of vegetation also influenced model performance: Clustered ➔ Intermediate ➔ Even. **5.** As spatial resolution decreases, model error increases.

5 References

Pacheco-Labrador, J., Gomarasca, U., Pabon-Moreno, D. E., Li, W., Migliavacca, M., Jung, M., & Duveiller, G. (2025). BOSSE v1.0: The Biodiversity Observing System Simulation Experiment. https://doi.org/10.5194/egusphere-2025-318

The funding for these actions/grants and contracts comes from the European Union's Recovery and Resilience Facility-Next Generation, in the framework of the General Invitation of the Spanish Government's public business entity Red.es to participate in talent attraction and retention programmes within Investment 4 of Component 19 of the Recovery, Transformation and Resilience Plan