

# Integrating EO and NFI data for enhancing the precision of AGB estimates: Assessing inferential strategies at different scales

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# Data availability for forest-related biomass estimation

Opportunity: More space based biomass information than ever

## National Forest Inventories Ground reference data



Peru's sampling frame - SERFOR

**Challenge:**  
Incomplete  
coverage and re-  
measurements of  
ground plots



Launched on **April 2025**





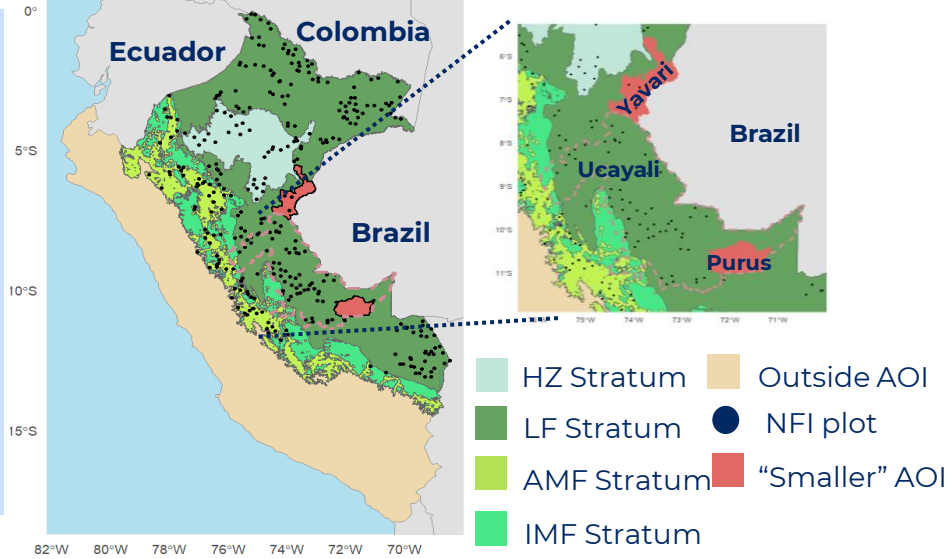
# Methodological Approach

## DESIGN-BASED

Probability sample

Sampling design

Estimators of the mean and variance



## Introducing EO biomass products as auxiliary information:

*Málaga et al., in prep.*

## MODEL-ASSISTED

Probability sample

Sampling design

Build a relationship between map units and NFI data

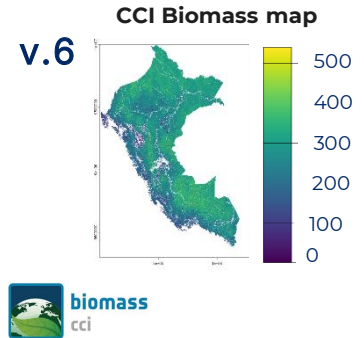
Estimators of the mean and variance

## (GEO) MODEL-BASED

Balanced reference data

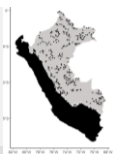
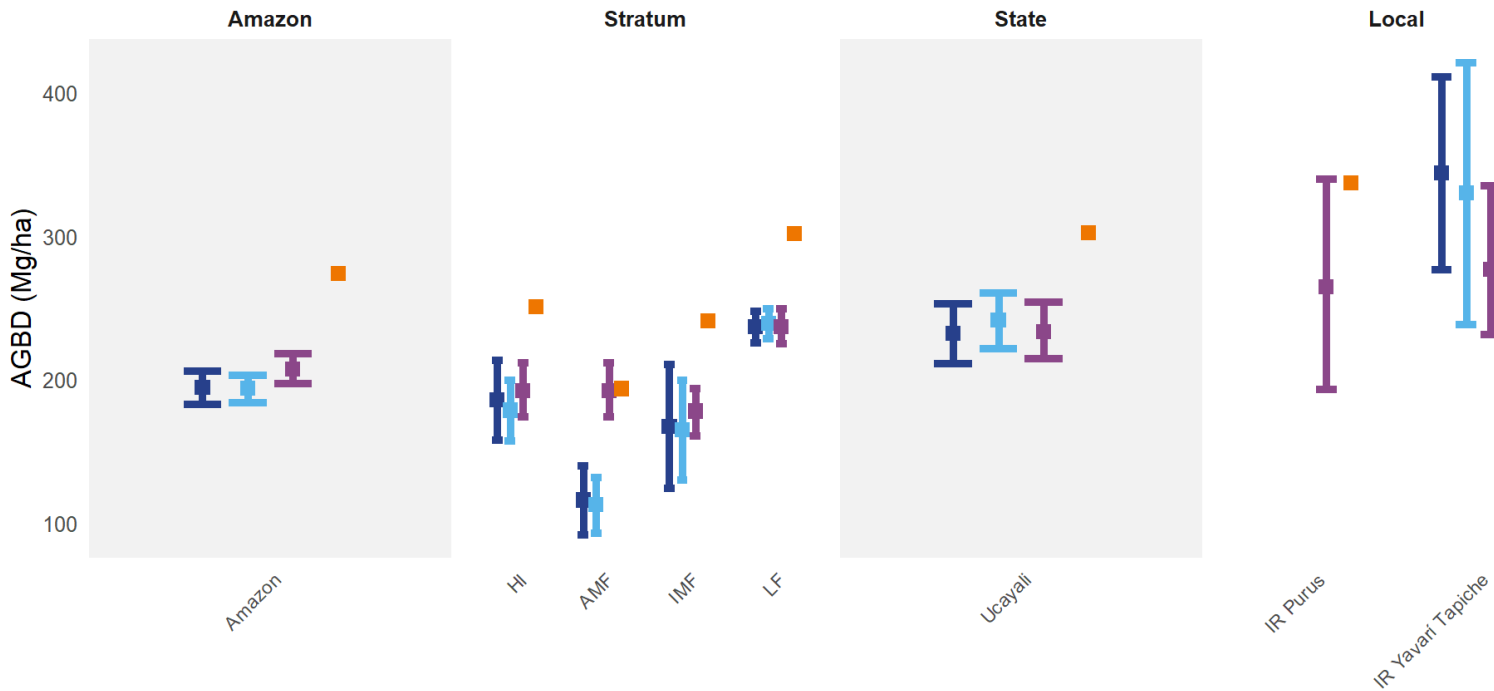
Estimate means and SE based on the model assumptions

Builds a spatial model between map units and NFI to predict



# Comparing inferential strategies across scales

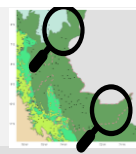
Preliminary results



329



32 63 13 221



62



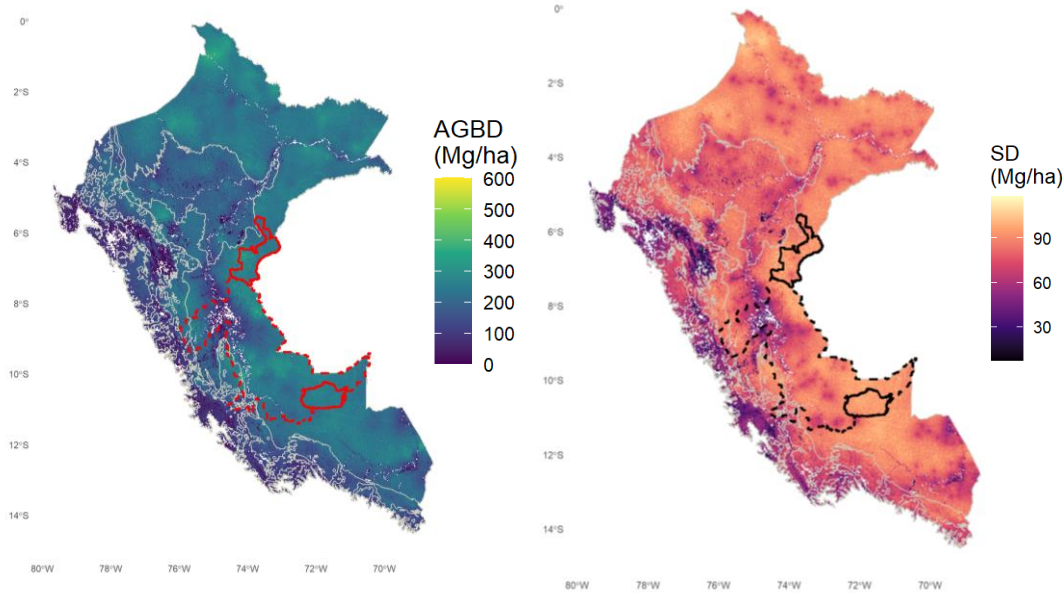
0 3

Number of NFI plots

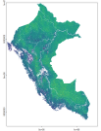
Málaga et al., in prep.

# Spatial predictions across the Peruvian Amazonia

$$y(s) = \beta_0^* + \beta_1 \cdot \text{CCI}(s) + w(s) + \varepsilon(s)$$



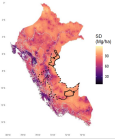
# Final remarks



Direct estimates of the CCI map (v6) are biased at most scales



EO biomass products can enhance (sub)national biomass estimates. Model-assisted and [most]GMB estimates of the mean are consistent with design-based, and show an **increase in precision**.

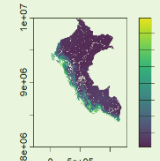


Geostatistical model based approach is a **powerful technique to have biomass predictions (including associated uncertainty) for specific areas of interest**

## Next steps:

- Assess other layers to improve model fit
- Cross-validation holdout to assess prediction error independently of the training data
- Test the framework in other countries with different NFI data availability and forest types

Copernicus GLO-90 DEM



Human footprint



# Thank you for your attention

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Thursday 7th:

11:45am	<b>Workshop - GFOI R&amp;D Session on integrating EO- and ground-data for enhanced forest-related biomass estimation</b> Location: James Cook
-	
1:30pm	

## Acknowledgements:

