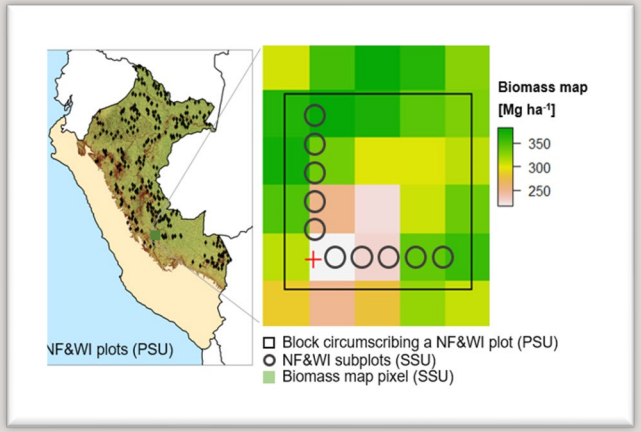
# Integrating space-based biomass and NFI data to enhance (sub)national forest-related biomass estimates

Natalia Málaga, Sytze de Bruin, Ronald E. McRoberts, Martin Herold, et al.



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GFZ Helmholtz Centre Potsdam

Forest Carbon Monitoring

biomass cci

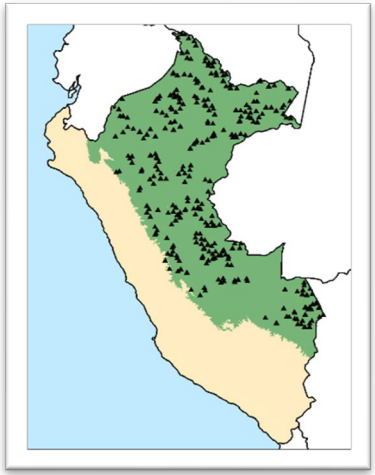
# A country case study in the tropics

- Evolving technologies and IPCC guidelines for the use of biomass maps in national GHG accounting
- Tropical countries struggling to complete or update NFIs
- A framework for enhancing the precision of (sub)national AGB estimates using a global biomass maps as auxiliary data, while taking into consideration the country's NFI sampling design
- Account for different sources of uncertainties from the integration of remote sensing-based products with ground-based data

**Peruvian Amazonia**: We assessed the gain of *precision* in AGB estimates from the use of the global biomass maps through 4 different scenarios

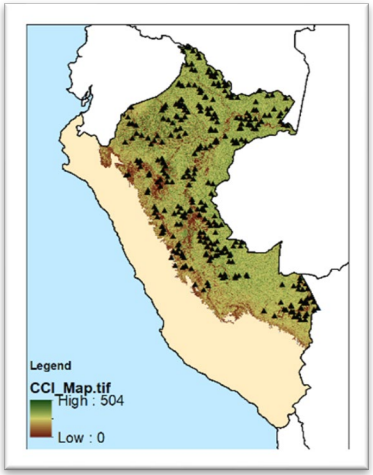
## Scenario A

### Baseline scenario



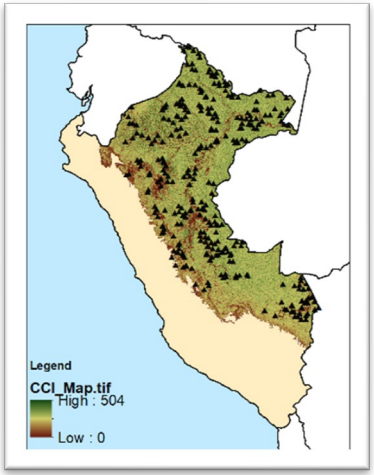
## Scenario B

### Using the uncalibrated biomass map




## Scenario C

### Using the locally calibrated biomass map




## Scenario D

[Accounting for uncertainties]

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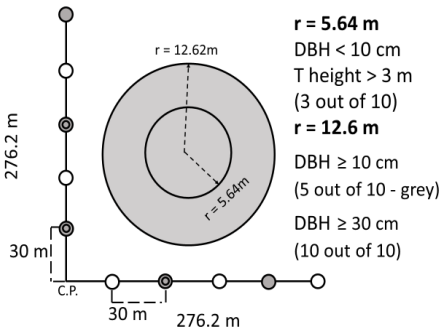
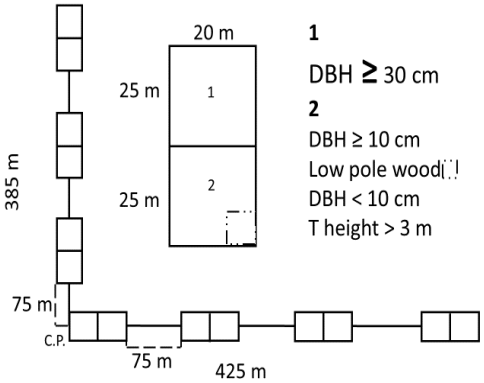
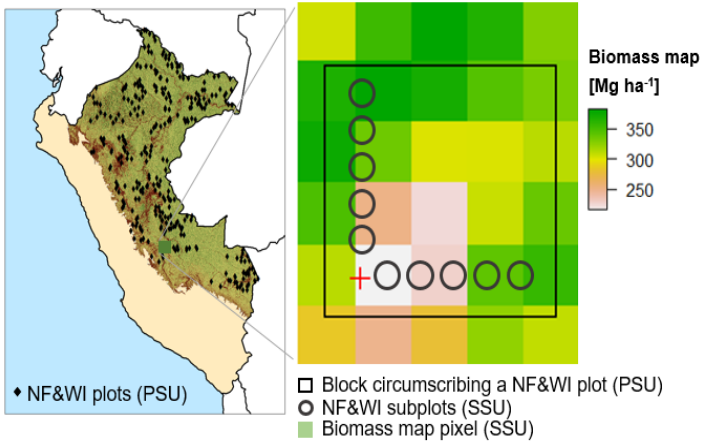
# Map-to-plot intercomparison

- NFI: 2013-to date
- 2017 ESA-CCI biomass map (v.3)
- Defined the inferential approach that best accommodated Peru's NFI sampling design

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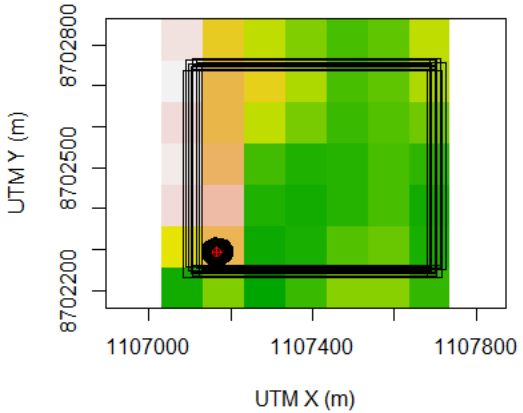
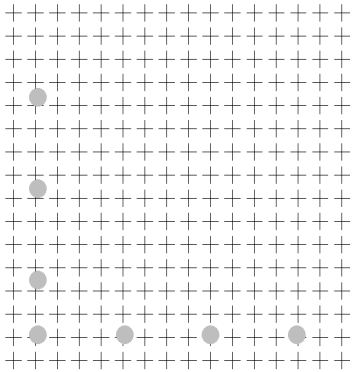
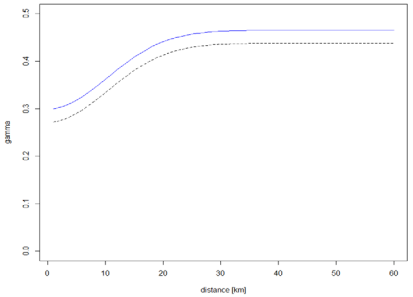
# Accounting for uncertainties using hybrid inference

P.V

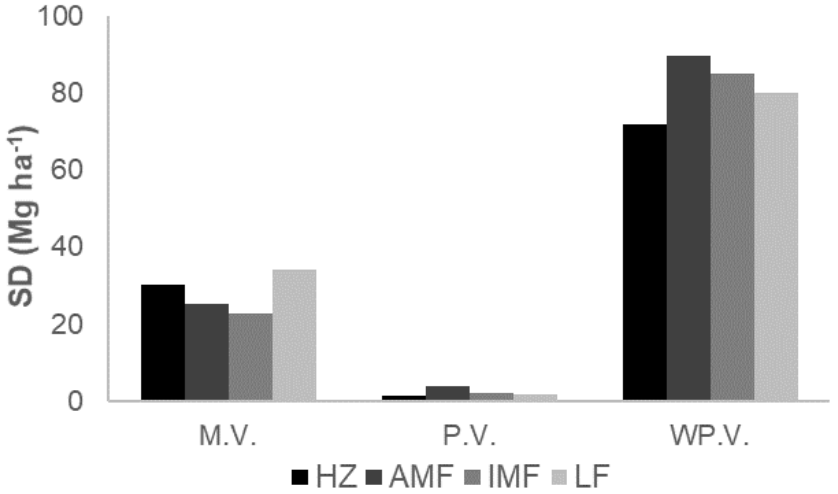



WP.V

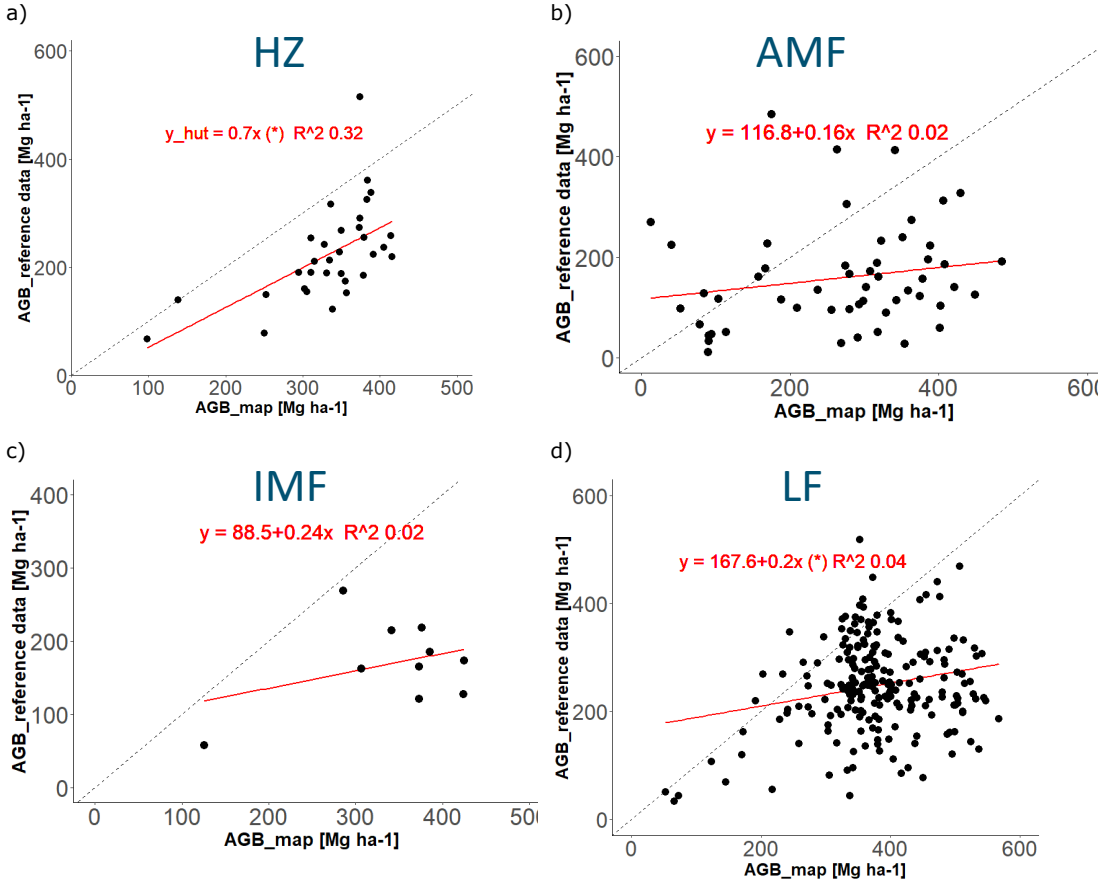





Stratum-wise mean standard deviations (SD) owning to the measurement variability (MV), positional variability (PV), and within polygon variability (WP.V).



# 2017 CCI biomass map local calibration – Scenario C

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# (Sub)national model-assisted AGB estimates for the Peruvian Amazonia

| | Baseline scenario (NFI) | | Uncalibrated map | | Calibrated map | | Including uncertainty propagation | |
|---|---|---|---|---|---|---|---|---|
| **Strata** | $\hat{\mu}_h$ | **SE** | $\hat{\mu}_h$ | **SE** | $\hat{\mu}_h$ | **SE** | $\hat{\mu}_h$ | **SE** |
| HZ | 212.4 | 13.7 | 208.5 | 13 | 213.5 | 12.6 | 213.3 | 14.9 |
| AMF | 148.7 | 17 | 142.4 | 19.9 | 156.3 | 14 | 161 | 14.1 |
| IMF | 147.9 | 27.7 | 175.1 | 27.5 | 170.7 | 17.4 | 178.5 | 20.1 |
| LF | 253 | 9.3 | 264 | 8.9 | 257.9 | 7.1 | 257.9 | 7.4 |
| Amazon | **208.7** | **7.9** | **217.7** | **7.9** | **217** | **5.7** | **219.3** | **6.2** |

$\hat{u}_h$ :mean AGB per unit area (Mg ha-1)
SE: standard error

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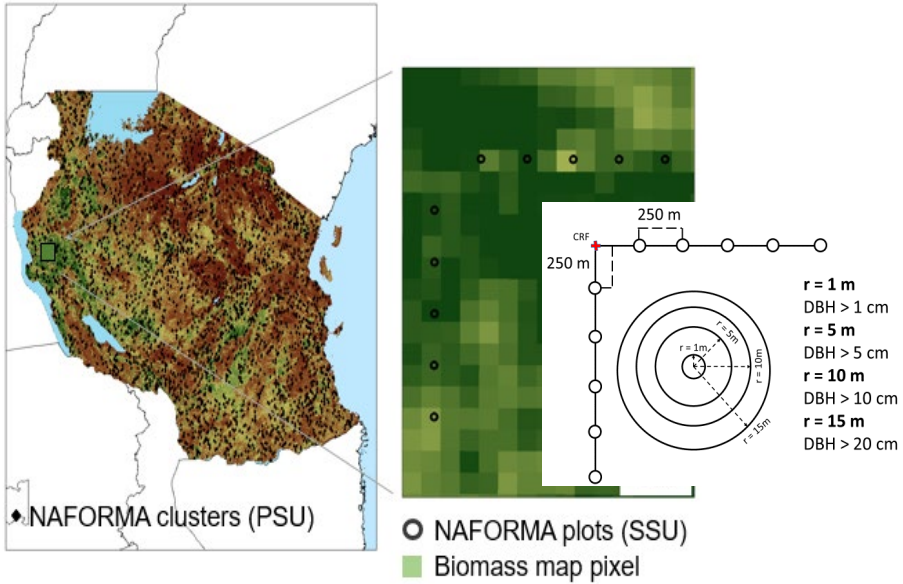
# Key-messages

- Even with small map-to-plot correlations, the precision for (sub)national AGB model-assisted estimates improved by 150% at the stratum level and 90% for the entire Peruvian Amazonia
- Refined country AGB estimates for GHG AFOLU reporting
- Our method accounts for sources of uncertainties in both NFI plots and satellite-based biomass estimation for better error assessment of the integration (scenario D) – IPCC good practice

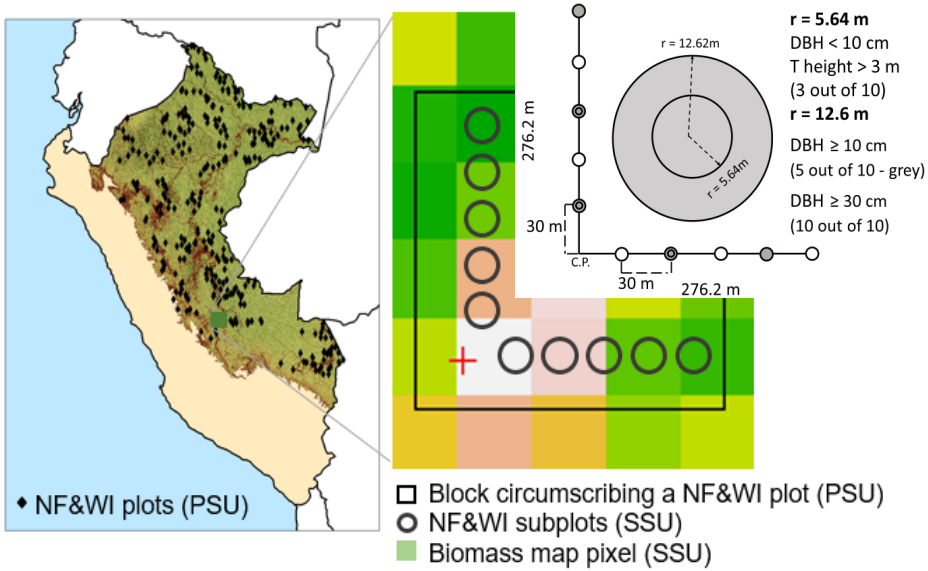
# Country comparative study in the tropics

## Defining the statistical inferential approach based on the country NFI sampling strategy

### Tanzania




### Peruvian Amazonia

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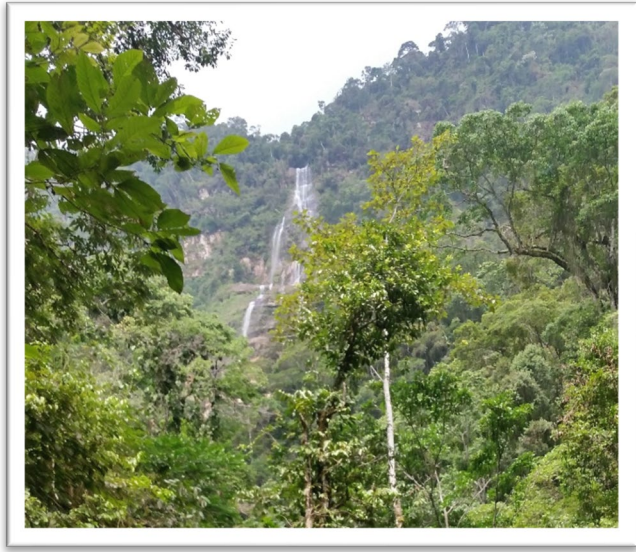
Thank very much for you attention!

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