EO for Biomass in Carbon Ratings

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EO for Monitoring, Reporting and Verification of Carbon Removals

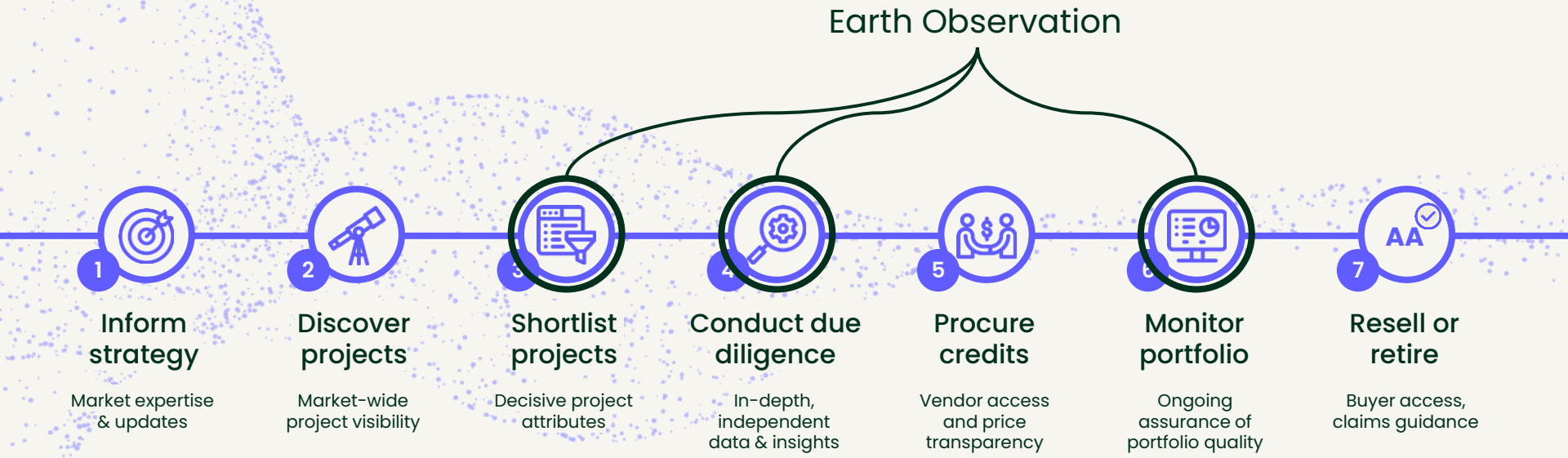
Copenhagen, 10 October 2024

Incentivizing investment in real climate action.

The carbon market faces major challenges

Low transparency	Rapid change	Unclear best practices
Lack of trust & confidence in the market	**Difficulty** shaping & **evolving strategy**	**High uncertainty** in likely investment outcomes

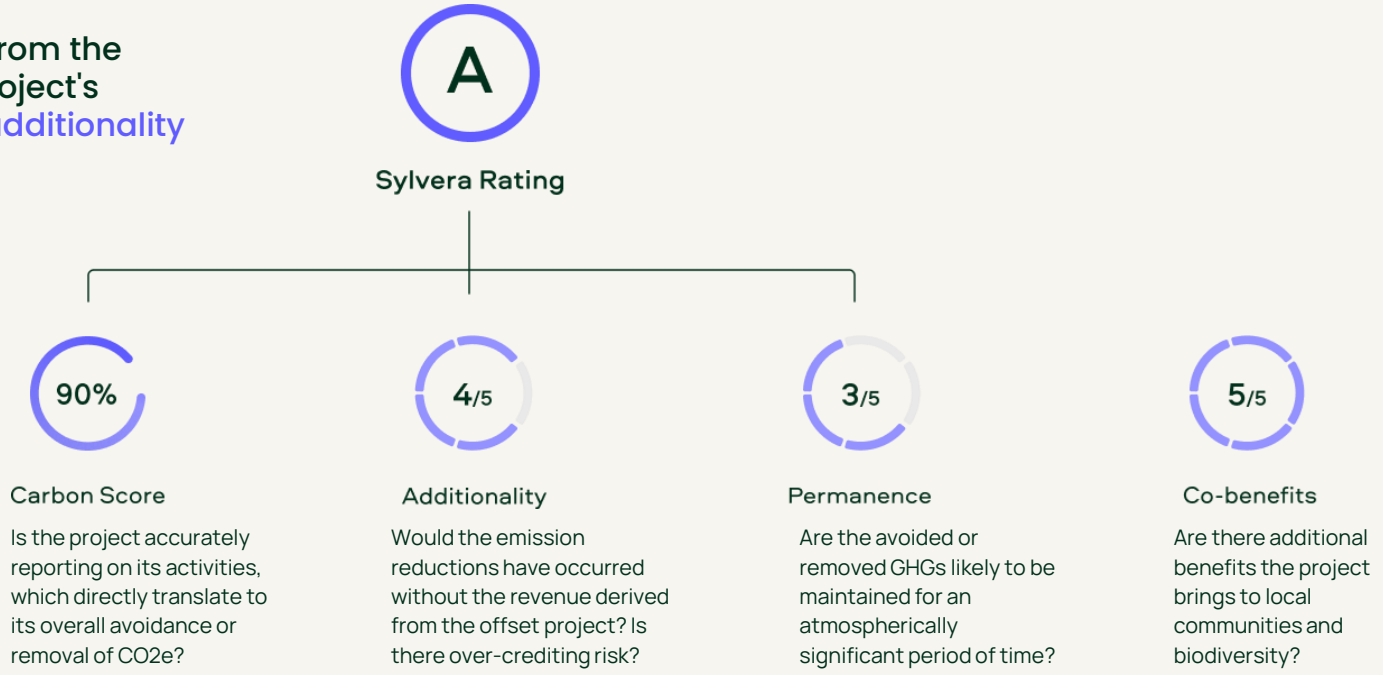
The end-to-end carbon offsetting journey



How we rate carbon offset projects

Sylvera Rating

Each rating is derived from the holistic analysis of a project's carbon performance, additionality and permanence.

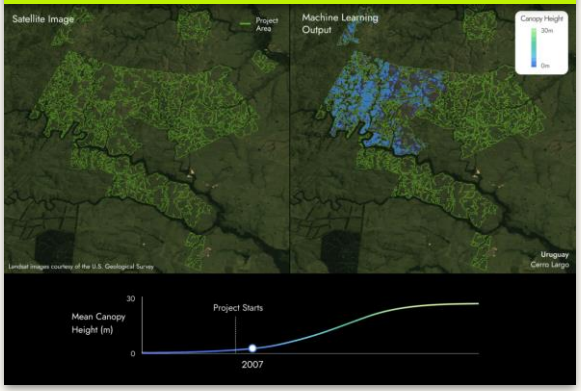


How we rate carbon offset projects

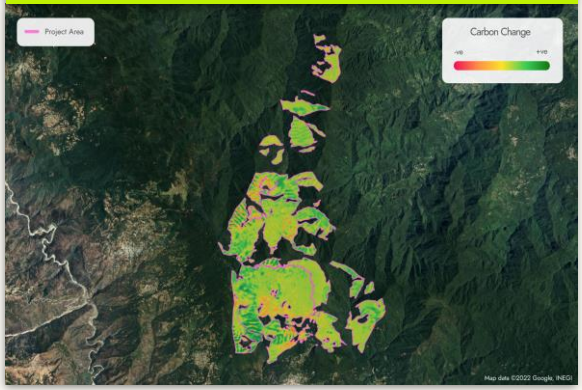
Forest Tracking

Tracking forest loss

Tracking forest growth



Tracking forest change



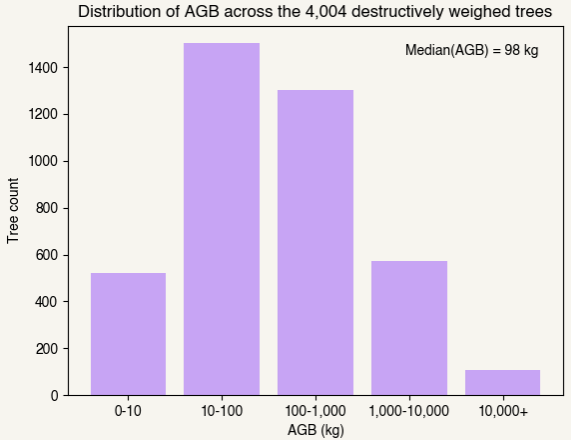
Tracking biomass stocks

Measuring biomass is hard

Conventional approaches combine simple structural measurements with shape-to-mass relationships

The use of allometry means the world's tropical forest carbon estimates are defined by 4,004 very small trees

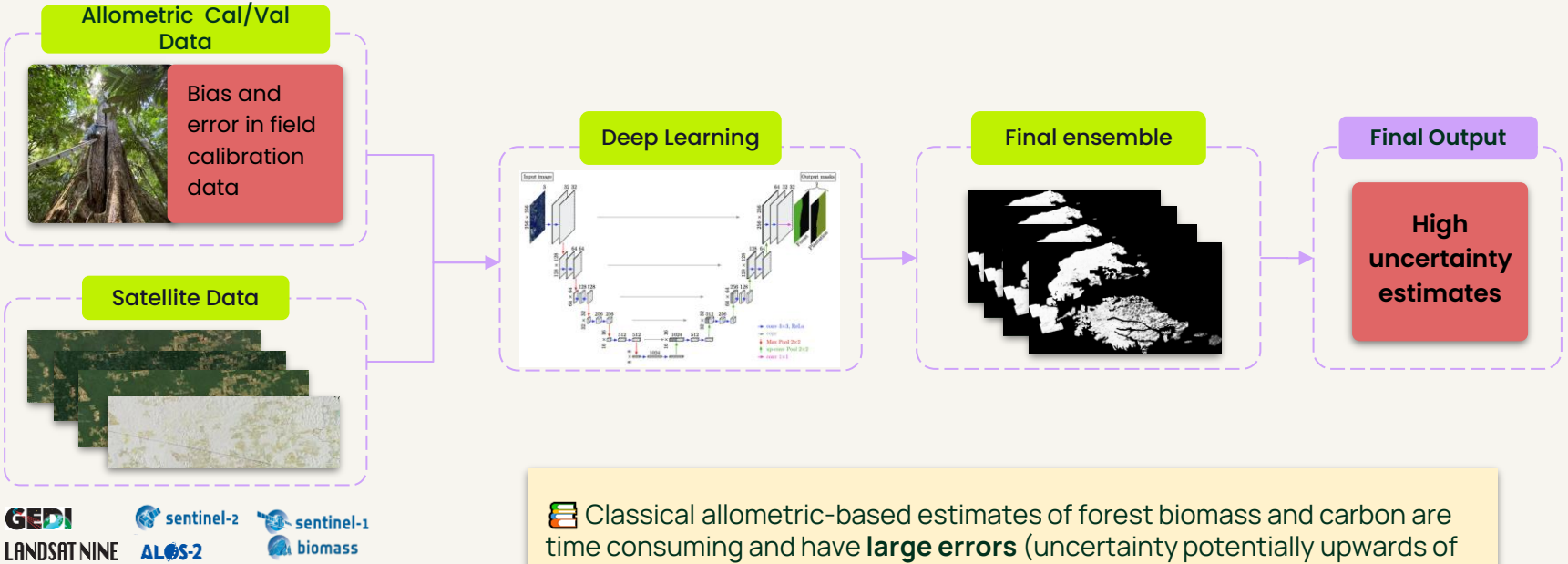
$$\mathrm{AGB}_{\mathrm{est}} = 0.0673 \times (\rho D^2 H)^{0.976}$$



Improved allometric models to estimate the aboveground biomass of tropical trees. Chave et al. (2014). *Global Change Biology*

EO models are only ever as good as their training data

Aboveground Biomass Density



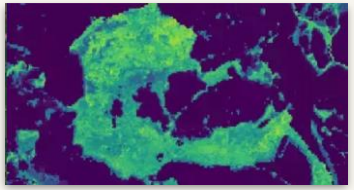
Classical allometric-based estimates of forest biomass and carbon are time consuming and have **large errors** (uncertainty potentially upwards of 40% at the stand-scale*), and are possibly **biased****

* Picard, et al. (2015). Reducing the error in biomass estimates strongly depends on model selection. Annals of Forest Science. doi: 10.1007/s13595-014-0434-9
** Gonzalez de Tanago, et al. (2017). Estimation of above-ground biomass of large tropical trees with terrestrial Lidar. Methods in Ecology and Evolution: doi: 10.1111/2041-210X.12904

EO models are only ever as good as their training data

Aboveground Biomass Density

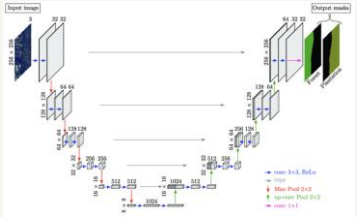
High quality biomass labels



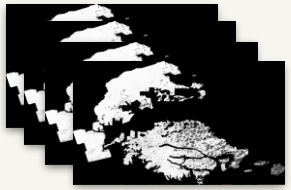
Satellite Data

GEDI LANDSAT NINE sentinel-2 ALOS-2 sentinel-1 biomass

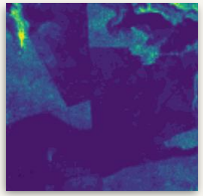
Deep Learning



Final ensemble

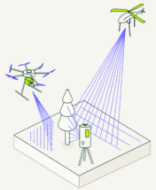


Final Output

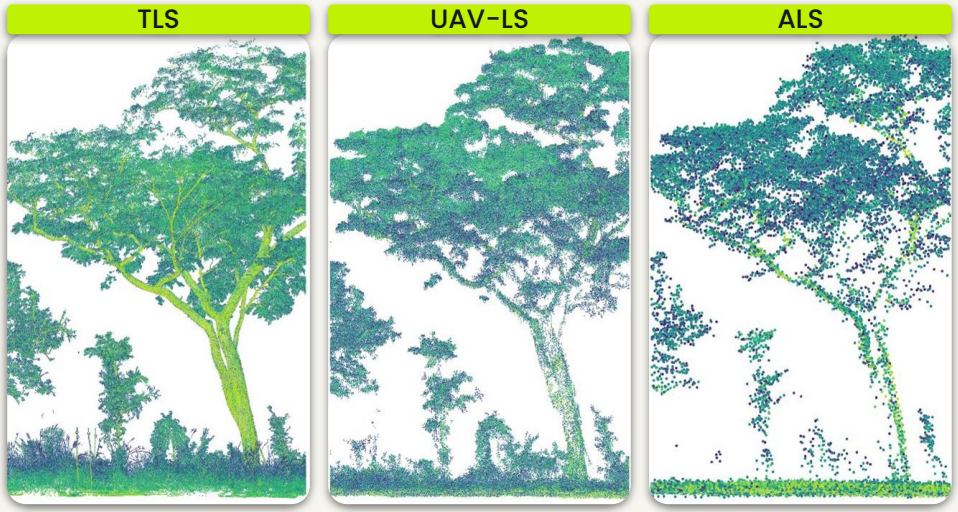


We must use high quality biomass data to underpin EO- and ML-based methods

Building the most accurate reference biomass dataset ever assembled



Multi-Scale LiDAR

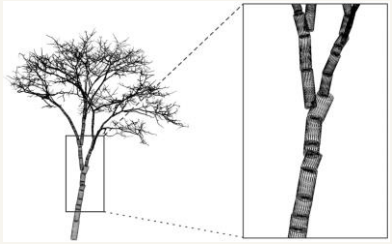


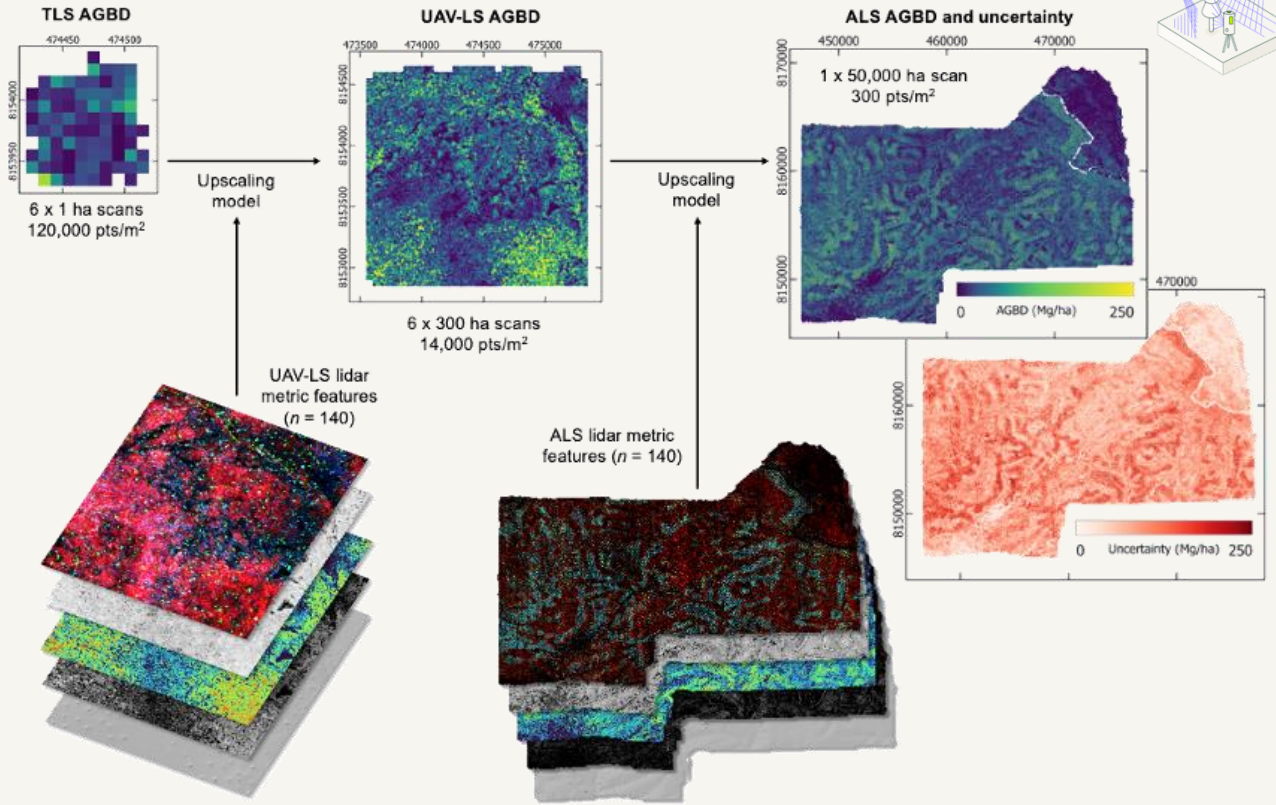
120,000 pts/m^2 14,000 pts/m^2 300 pts/m^2

...

*Burt et al. 2021 New insights into large tropical tree mass and structure from direct harvest and terrestrial lidar. R. Soc. Open Sci.8201458
Gonzalez de Tanago et al. 2018 Estimation of above-ground biomass of large tropical trees with terrestrial LiDAR. Methods Ecol Evol. ; 9: 223–234.

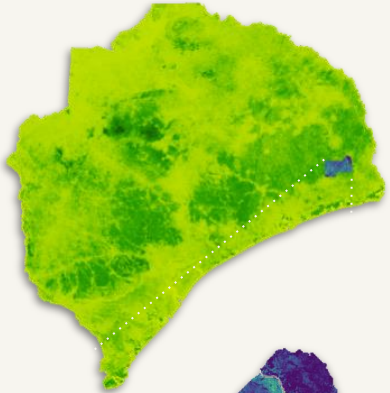
AGBD Multi-Scale LiDAR

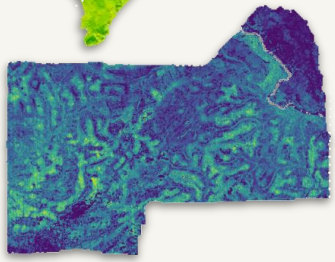




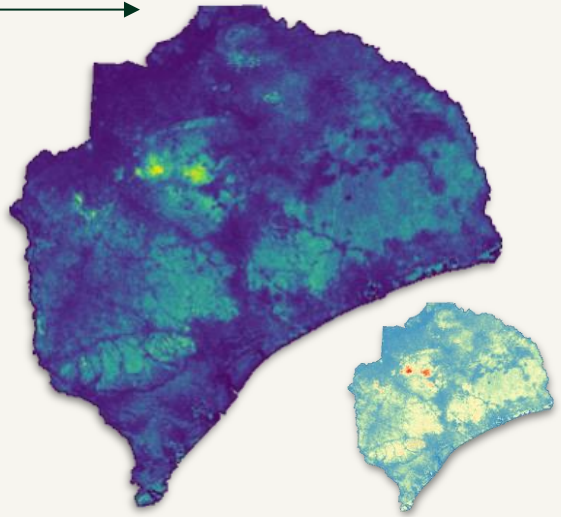
Calibrating EO data with AGBD-ALS

Canopy Height

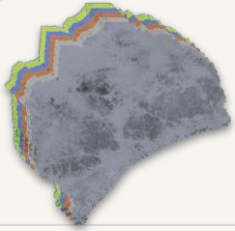


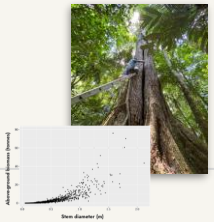


Biomass



- Spaceborne Lidar GEDI L2A Canopy height (reference)
- Multispectral (L8)
- SAR (PALSAR-2)



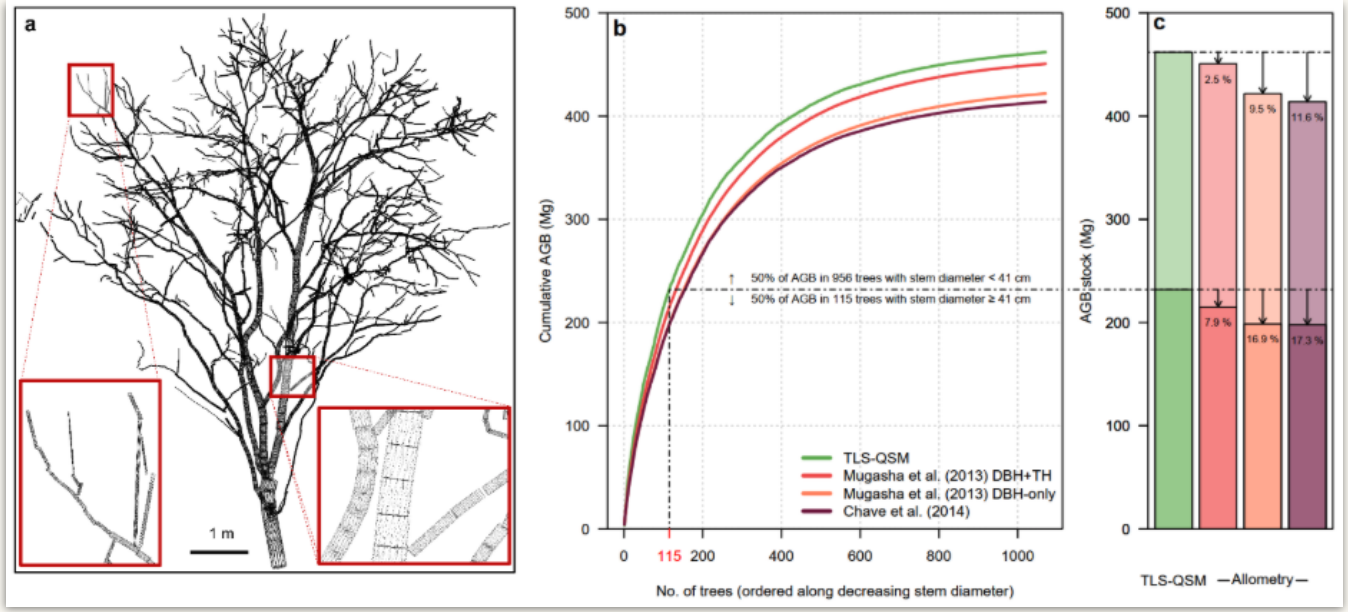


Reference data

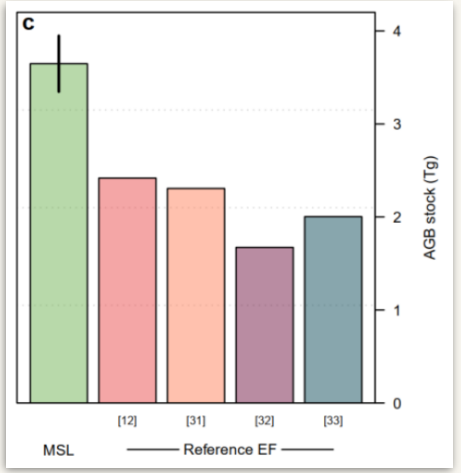
- MSL-calibrated ALS
- Traditionally-calibrated ALS (based on allometries)

Building the most accurate reference biomass dataset ever assembled

Multi-Scale LiDAR



Recent publication:
Demol, M., et al. (2024), *Multi-scale lidar measurements show miombo woodlands may contain substantially more carbon than thought*. Communications Earth & Environment, 2024



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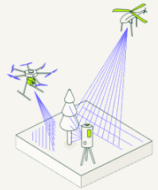
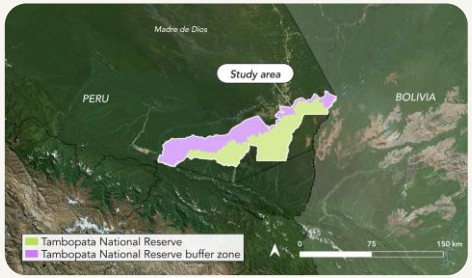


Multi-Scale LiDAR

Biomass, soil organic carbon, deadwood and litter measurements over **50,000 ha** in Tambopata National Reserve in the **Peruvian Amazon** in 2023. We'll also be analysing **flux** tower data.



+ additional sites in Cameroon, Mozambique, Gabon, Peru, UK, Belize, Australia, …

Key Questions

1. What role do accurate unbiased carbon measurements play in ensuring quality and transparency in the carbon markets?
2. How do we systematically incorporate in situ/multi-scale measurements in MRV systems?
3. What is the value of robust uncertainty estimation?

Learn more at sylvera.com/research

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