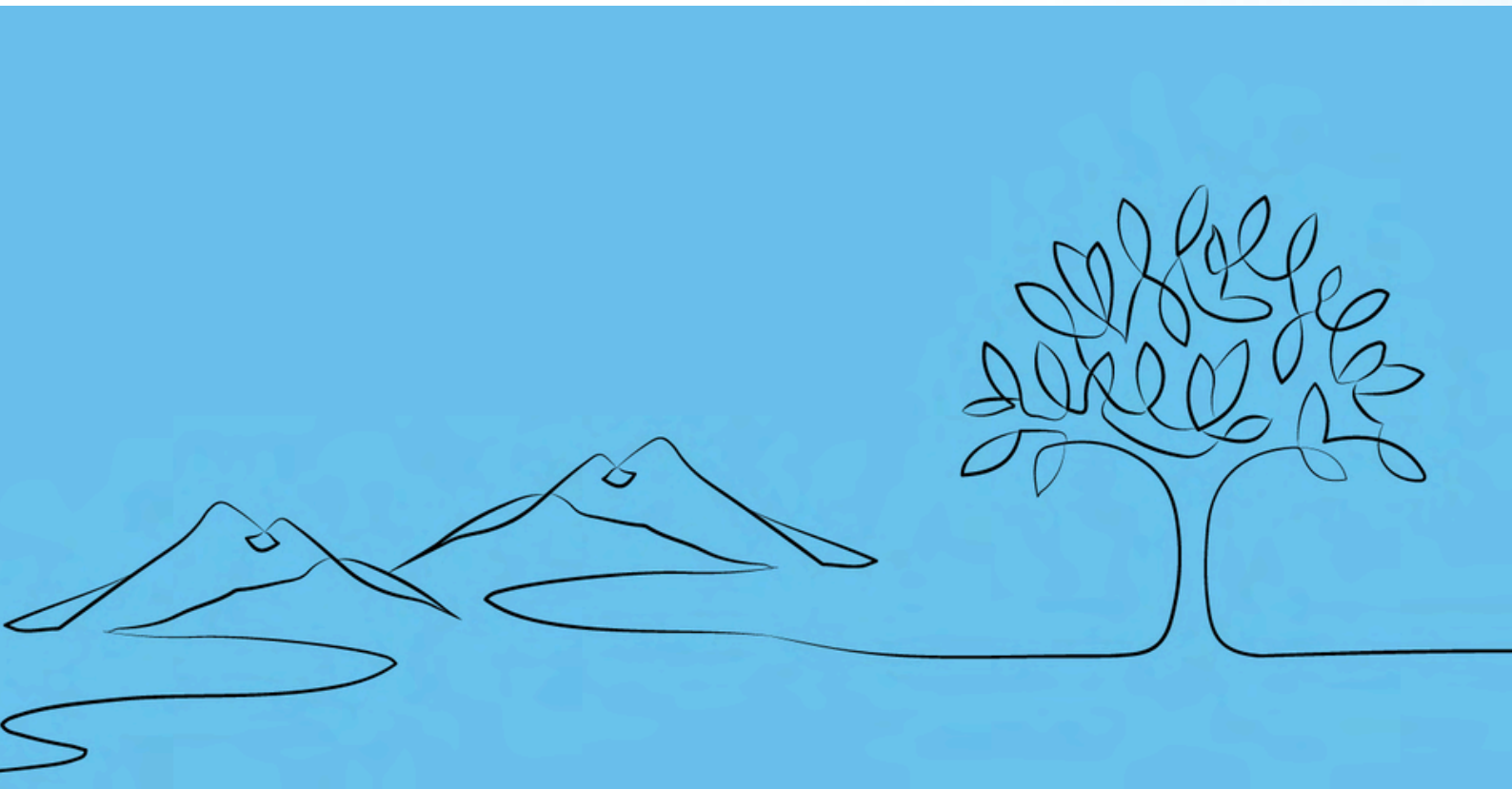
Thryve
.Earth

Using biomass to estimate CO_2

2025



Biomass mapping for smart carbon decisions

At Thryve, we use biomass mapping as a foundational input for designing and validating our nature-based carbon removal projects. Biomass data helps us understand exactly how much carbon is stored in a landscape today and how much more it could store in the future. This enables more accurate baselining, stronger additionality claims, and more transparent CO_2e forecasts.

We identify biomass models and equations specific to the local biome, ensuring they closely reflect the ecological characteristics and effects of the region. We validate these models using our own on-ground field measurements. This ensures that every decision we make - about where to prioritize interventions, how to estimate carbon removal potential, and how to monitor impact - is grounded in spatially accurate, context-specific data.

Why biomass data matters

To develop credible carbon projects, we need to understand how much carbon is already stored in a landscape, and how that changes over time. Biomass estimation provides that insight, improving outcomes across multiple dimensions:

Ensures additionality

Areas with high existing biomass aren't eligible for reforestation or restoration credits. Time series biomass data helps us identify and exclude those areas early, ensuring our efforts focus on locations where we can achieve real, additional CO_2 removal.

Prevents overestimation and underestimation

Land cover classifications alone can mislabel areas as degraded. Biomass layers reveal the true carbon storage potential of a site, helping us avoid over-crediting and wasted resources.

Supports long-term credibility

Understanding how biomass varies across a project allows us to model permanence and storage potential more accurately over time.

Improves leakage mitigation

By identifying high-biomass zones nearby, we can better anticipate and avoid displacement risks, preserving the net climate benefit of our projects.

Maximizes climate impact per dollar

Biomass data helps us focus on areas with the highest potential for additional carbon removal, ensuring every investment drives measurable, meaningful impact.

Benefits for stakeholders

For capital partners

Risk mitigation: Better risk mitigation through credible, data-backed carbon yield estimates.

MRV compliance: Improved trust and compliance with MRV (Monitoring, Reporting, and Verification) requirements.

Capital efficiency: Higher climate impact per dollar invested

For landowners

Project clarity: Clear understanding of which areas are eligible for carbon projects.

Land use optimization: More efficient land use by avoiding zones already storing significant carbon.

Revenue accuracy: Accurate long-term revenue potential from better-calibrated CO_2 projections.

For field organizations

Targeted checks: More efficient field checks through biomass-informed targeting.

Improved planning: Better restoration and planting strategies.

Better success rates: Higher project success rates are driven by better planning.

Where global biomass datasets fall short

Many global biomass datasets are a helpful starting point, but they're **not designed to meet the precision demands of high-integrity carbon project development**.
Most rely on outdated data, low spatial resolution, and models trained on broad, non-localised inputs.This limits their ability to reflect the real conditions of specific landscapes, especially in tropical or fast-changing ecosystems.

Even popular commercial solutions often fall short in the regions we operate.
Their models are not trained with ground-verified, site-specific data, and without this local calibration, estimates of existing carbon stocks can be significantly off the mark.
That introduces risk, both in terms of credit overestimation and project credibility.

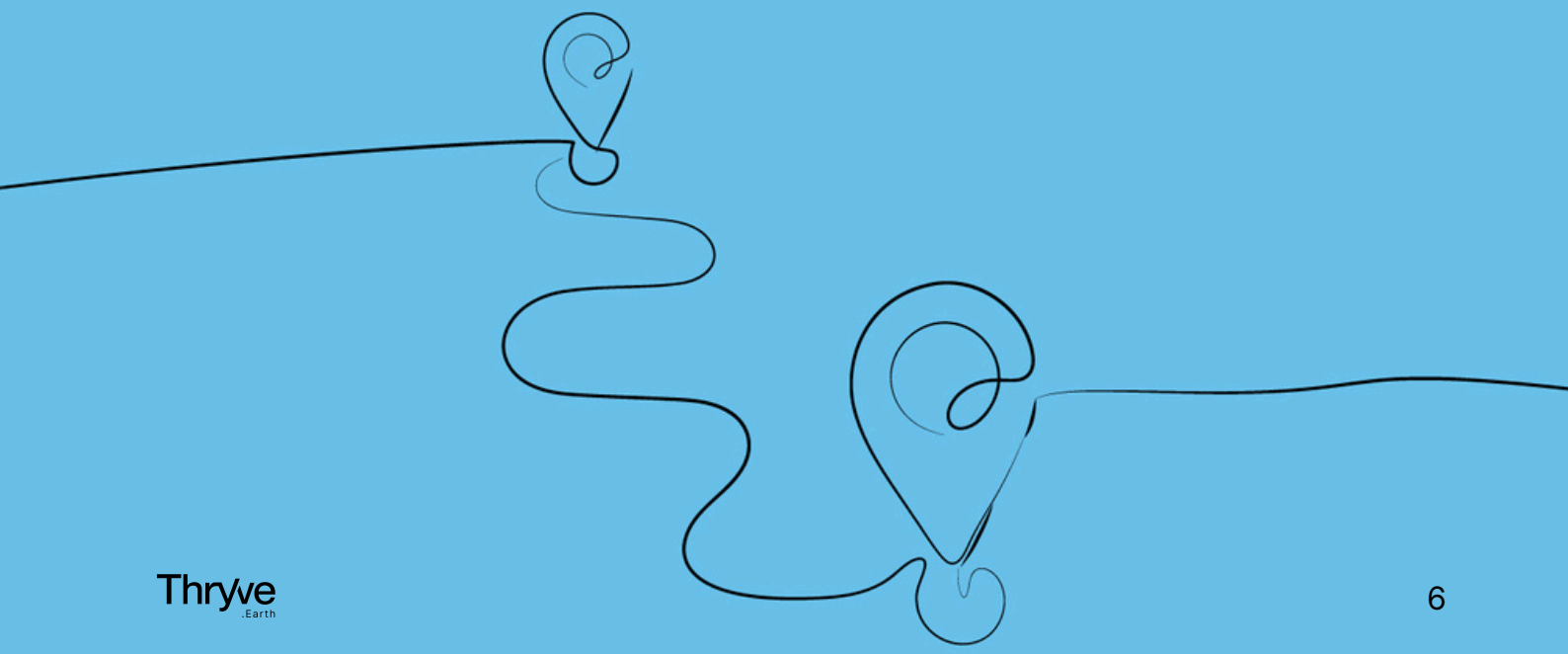
Existing solutions and their limitations

Optical-only machine learning models:

These models use **optical satellite imagery** to estimate biomass. However, their accuracy drops in **multi-storey canopies,** where dense foliage obscures the woody structure below - exactly the kind of complexity found in many landscapes.

Single-sensor SAR algorithms:

Radar-based approaches are less affected by clouds and offer consistent data acquisition. Yet they face their issues: terrain-induced distortion, soil moisture variability, and angle-related inconsistencies. These limit **reliability without extensive correction.**



Our approach: A robust, multi-sensor biomass mapping pipeline

At Thryve, our Nature-based Solutions (NbS) and GIS Specialists are using a multi-stage geospatial pipeline designed to overcome the limitations of common global datasets.

Building biomass layers

We create high-resolution spatial biomass layers across potential project areas by combining remote sensing data with peer-reviewed, location-specific scientific equations and validating with field based measurements. This gives us an accurate and detailed view of current above-ground carbon stocks.

01 Fetching the satellite dataset

02 Measuring field Biomass for training

03 Creating deep learning models

04 Validating Models

05 Creating prediction maps for biomass

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How we use biomass layers

Validating eligibility:

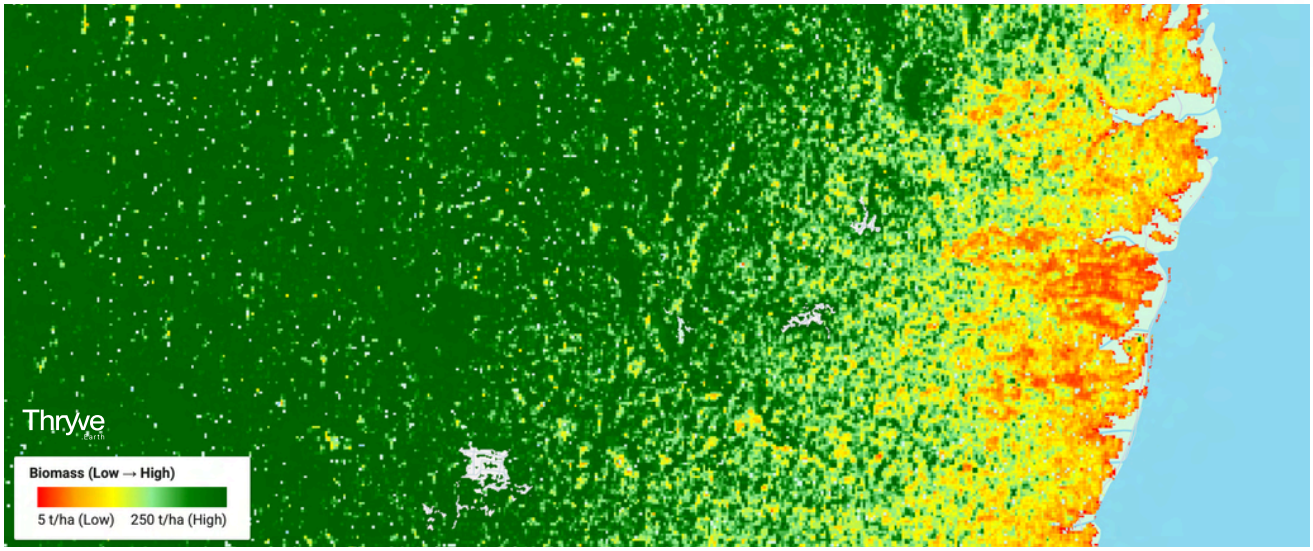
We combine land use/land cover (LULC) classifications with biomass thresholds to fine-tune eligibility. In some cases, areas flagged as degraded - like shrublands or dense grasslands- show high biomass. Biomass data helps correct these misclassifications, preventing over-crediting and strengthening project integrity.

Estimating CO_2 potential:

We use biomass baselines to estimate the carbon yield of a project over time. This feeds into our carbon accounting models and informs assumptions around additionality and permanence. Improved accuracy builds trust with capital partners and standards bodies.

Supporting transparent mapping:

We overlay eligible areas with biomass data to create detailed carbon maps. These are shared with stakeholders as a visual record of how the carbon opportunity was assessed. This enhances transparency and reinforces confidence across the board.



The image above is a reference biomass map from one of our projects. This map highlights spatial variations in biomass distribution, supporting our analysis and decision-making efforts.

How we’re different

What sets Thryve apart is our access to in-country implementation partners who collect and share ground-truth biomass data. Currently, we are choosing global datasets/equations/models based on our field biomass measurements, and in the future, we plan to develop our own region-specific biomass model.

Our vision

To further enhance this and improve the accuracy of biomass estimates at the local level, we’re now integrating machine learning (ML) and deep learning (DL) algorithms along with field biomass measurements into our process. → This means we'll be able to more precisely quantify the carbon impact of each project - how much CO_2 we can remove from the atmosphere - and more accurately forecast CO_2e outcomes over time.

The bottom line

Biomass mapping dramatically improves the quality, credibility, and climate impact of nature-based carbon projects. At Thryve, we’re combining cutting-edge remote sensing, field data, and machine learning to ensure that time, effort, and investment are directed toward areas with real potential for additional CO_2 removal - maximizing the climate benefit of every project.

Thryve develops high-quality Nature-based Solutions (NbS) carbon projects that regenerate ecology.

By combining a locally grounded and tech-enabled approach with rigorous project management and strong governance, we create resilient returns and lasting value for capital partners, landowners, and communities.

Interested in learning more?

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