Thryve
.Earth

Building a Programmatic Carbon Engine for Nature-based Forestry Projects

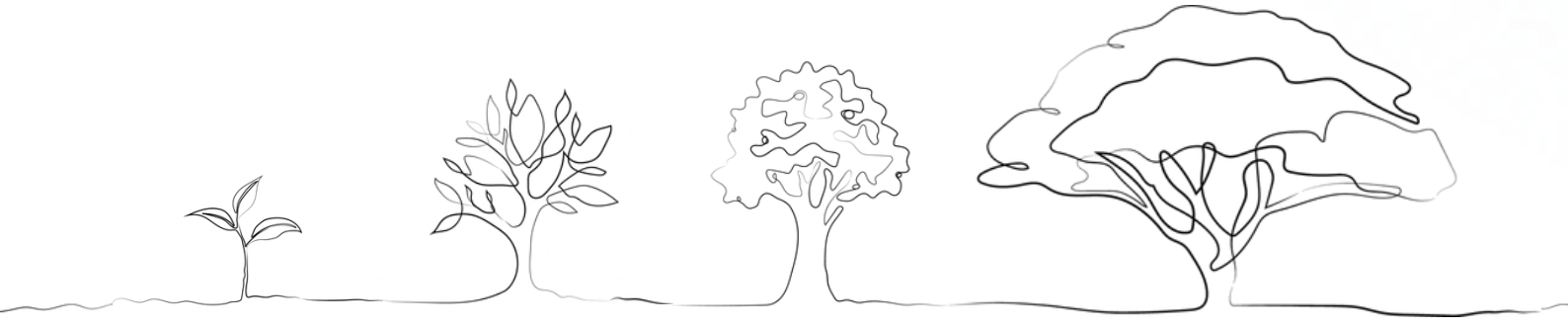
2026

Carbon modelling as a lever for change

Carbon modelling informs three critical decisions at Thryve: which lands to prioritise (scoping), which species configurations to consider (design), and whether projected yields can support investment decisions. It quantifies baseline carbon stocks across above-ground biomass, below-ground biomass, and soil organic carbon; it also projects potential removals and avoided emissions over the crediting period. We are building programmatic modelling capabilities to enable faster iteration across multiple project designs - including species mix and density, grounded in local context and intended to balance farmer preferences, ecological fit, commercial demand, and carbon yield.

As these capabilities evolve, this direction will help align restoration efforts with operational suitability by identifying degraded, high-opportunity landscapes (and/or) lands, and by focusing on appropriate land (e.g., low slope, accessible areas). The aim is to strengthen ecological outcomes while supporting long-term value for local communities.

Carbon yield across the project lifecycle



Establishment phase, minimal sequestration	Rapid growth, peak annual sequestration rates	Maturation, declining annual rates but substantial cumulative storage	Stable carbon stocks with periodic harvests (agroforestry) or long-term permanence (conservation)
Y1-3	Y4-12	Y12-25	Y25+

What are the limitations of manual modeling?

- Carbon modeling relies on land-cover data, ecological parameters, species-specific growth curves, project duration, and regional baselines.
- Each project type follows a distinct methodological framework: ARR projects typically use Verra's VM0047 or Gold Standard A/R methodologies; IFM projects apply VM0010 or VM0012; and REDD+ projects follow VM00048. Each carries subtly different baseline modelling approaches, monitoring requirements, and buffer pool contributions.
- Each project is managed in its own spreadsheet with hard-coded assumptions, increasing the risk of inconsistencies and making cross-project comparison difficult.
- Multiple spreadsheet versions lead to fragmented tracking, where planting plans, nursery inventories, and farmer records often remain disconnected.
- As data volumes grow, manual integration becomes increasingly hard to scale or standardize, resulting in error-prone workflows, operational bottlenecks, and heavy reliance on a small number of domain experts who understand the underlying logic - creating knowledge silos and single points of failure.

ⓘ How is Thryve evolving beyond manual modelling?

By building and progressively operationalising a programmatic tool that improves accuracy, scalability, and speed, which benefits all the stakeholders.

Scaling carbon projects with programmatic workflows

Several critical project elements are informed by our carbon models, such as: projecting credit yield and making decisions on the optimal species mix. Previously, these processes heavily relied on error-prone and time-consuming spreadsheets. By moving from manual processes to a programmatic approach using Python, we minimize human error, significantly reduce manual effort, accelerate processing, and ensure greater consistency. This is expected to enable better scalability and higher-quality outputs. Crucially, this provides the ability to quickly iterate on multiple designs based on field inputs to land on the optimal project design, which maximizes adoption and permanence.

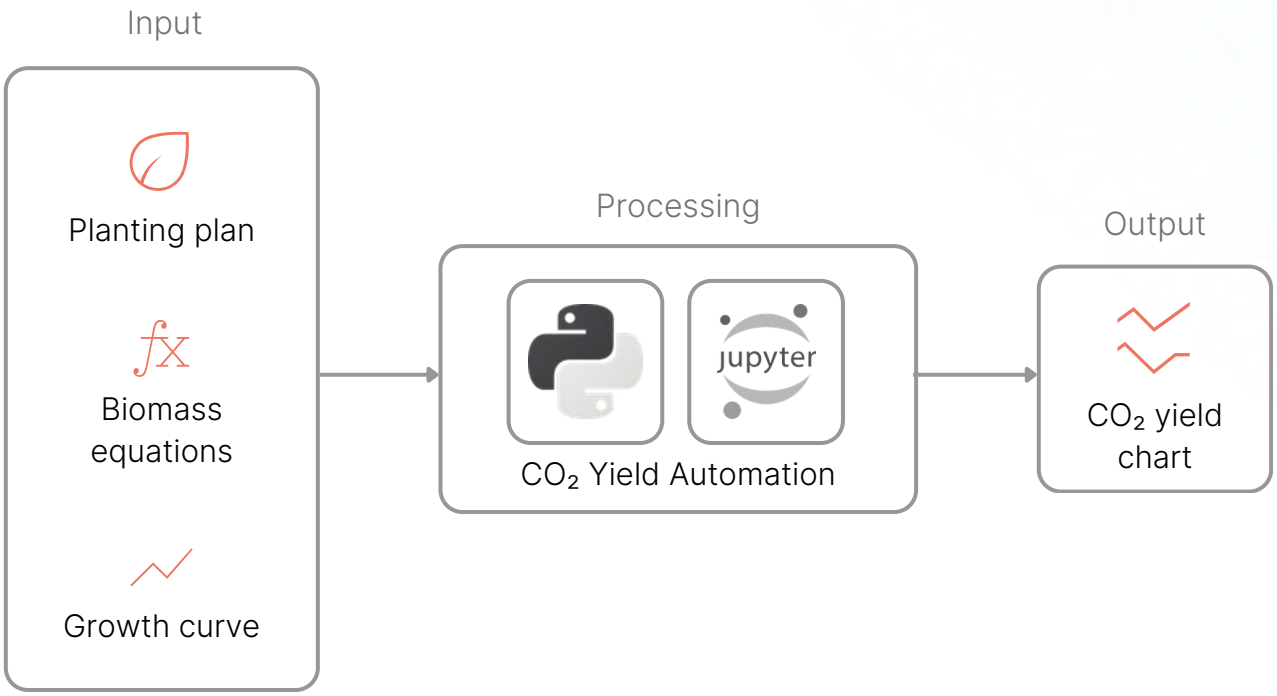
Comparison of manual vs. programmatic carbon modelling

	Manual	Programmatic
Tool	Excel spreadsheets	Python-based script
Speed	4-6 hours to model one project scenario	Generate 10+ scenario comparisons in under a minute
Error risk	High transcription/formula error risk	Eliminates manual input errors; enables systematic validation checks
Scalability	Hard to scale and standardize	Flexible across ARR, IFM, REDD+ projects
Inputs	Manual data entry for every project instance	Shared database across projects (species & growth parameters)
Output	One-off spreadsheet requiring rebuild for each project	Reusable model that generates per-hectare credit projections with uncertainty ranges, deployable across any new project area

Thryve's solution: Building a programmatic tool

At Thryve, we have established the early foundations of a flexible, programmatic carbon modeling capability intended to support a range of stakeholders across the NbS ecosystem, from project teams to investors and landowners. The tool is being developed to progressively integrate planting plans, biomass equations, and growth curves, enabling more consistent and efficient estimates of carbon potential over time. Our efforts are currently focused on strengthening investor-facing insights, with the longer-term objective of supporting broader workflows, including project planning and structured field processes such as farmer onboarding.

CO_2 yield programmatic workflow



How does this tool empower every stage of carbon projects?

1. Investor reporting

Investors prioritise clarity and speed. To support this, our modelling capabilities are being developed to provide carbon yield forecasts, baseline comparisons, and financial summaries based on structured project inputs. Stakeholders will be able to review assumptions, run scenario and sensitivity analyses, and export standardized outputs for evaluation.

2. Origination prospecting

Before launching a project, our NbS team assess its carbon and financial viability using established datasets and project logic. As modelling capabilities mature, this approach is expected to further streamline site prioritisation while reducing manual analytical effort.

- Faster decision-making and assessing the overall impact
- Carbon potential at the district or village level
- Exportable summary reports to guide internal decision-making

3. Farmer onboarding

At the community level, our modelling approach is designed to support faster, more structured assessments of land suitability and project potential by simplifying how key inputs are captured and evaluated. This helps field teams and farmers/landowners have clearer, more informed discussions early in the project lifecycle. As these capabilities mature, they are intended to support more consistent estimates of eligible area, indicative carbon ranges, and long-term value without increasing complexity at the field level.

Unlike static spreadsheet workflows, our programmatic approach is being designed for greater flexibility, field alignment, and scientific rigor as adoption expands.

How does this tool empower every stage of carbon projects?

4. On-ground implementation:

Our tool extends beyond carbon forecasts; it directly supports on-ground implementation in our Indonesia and India projects.

- Supporting more informed planting decisions within defined project parameters.
- Enabling faster evaluation of design options to inform planning and decision-making.
- Improving continuity between planning, implementation, and tracking as projects progress.
- Providing clearer, more consistent modelling outputs to support project permanence and investor clarity.

As these systems evolve, closer alignment between modelling and implementation is expected to help stakeholders, including farmers, field teams, and investors, operate with greater clarity and confidence.

Benefits of programmatic carbon modelling for stakeholders

For capital partners:

- Faster access to carbon yield estimates as models are progressively standardised.
- Standardised models adapted to major registries (e.g., Verra, Gold Standard, SRN Indonesia) for easier comparison and due diligence.
- Increased confidence in assumptions, baselines, and projections.

For landowners & field organizations:

- Improved coordination of planting activities through structured consultation with field implementers (e.g., via shared digital maps and real-time updates).
- Revenue projections and estimated credit yields and indicative income streams across 10, 15, and 20-year horizons, enabling informed participation decisions.
- Reduced complexity through simplified, automated inputs, such as land-use data, eligible areas, species databases, and farm boundaries.
- Flexibility in choosing planting species and incorporating NTFPs (non-timber forest products) through timely updates.

Looking ahead: Building transparent, scalable carbon tools

We are focused on making carbon modelling workflows more structured, faster, and easier to audit by moving away from fragmented spreadsheets toward programmatic tools. This approach is intended to reduce manual errors, improve comparability across projects, and create a scalable foundation that supports clearer decision-making for investors, project teams, and landowners as projects grow.

In the noisy market of Nature-based Solutions (NbS), we at Thryve aim to bring transparency and accuracy to an industry that heavily relies on predictions and modeling. In an attempt to improve the existing systems, we plan to expand on the current tools and platforms for more accurate and scalable predictions to bring predictions closer to on-ground outcomes. Our efforts are centred on strengthening the underlying systems that support carbon estimation.

With our current and future tools and platforms, we aim to create a more efficient infrastructure where every once-manual task can be streamlined into a programmatic system, and all this while keeping the workflow stakeholder-friendly.

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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