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European Union



EIT AI COMMUNITY

Take Root Bio Technologies
AI-Enhanced Community Digital Twin
for Urban Biospheres

AI Challenge 2025



Challenge description

Develop an AI system that integrates real-time sensor data from modular TRB AgriFood Ecosystems with Earth Observation (EO) inputs to:

- Accurately track changes in air composition (e.g. CO₂, CH₄)
- Differentiate between local emissions (e.g. aquaponics, CEA respiration) and external atmospheric trends
- Support dynamic carbon capture estimation and regulatory reporting

Additionally, the system must optimise growing conditions for diverse species (fish, fungi, dwarf trees, leafy greens) by interpreting sensor inputs to improve yield, prevent disease, and increase energy/resource efficiency.

add your challenge description here

Why is this a challenge/opportunity to overcome?

- Carbon capture claims require traceable, sector-specific GHG accounting, not generic offsets
- CEA environments produce fluctuating emissions and uptake (e.g. night-time CO₂ spikes) that need high-resolution modelling
- Integrating EO-based air change data (e.g. Copernicus Atmosphere Monitoring) with local biosphere dynamics remains unstandardised
- A reliable AI would enable climate finance integration, improve circularity, and automate GHG reporting



Did you try out a solution for this already?

We are trying to prototype a static GHG dashboard and rule-based control systems. These lacked spatial sensitivity, couldn't differentiate atmospheric trends, and couldn't adapt to plant cycles or air change rates. This is based around a project with Satalite Applications Catapult in the UK. However, it is not dynamic nor producing the expected results as is heavily manually reliant on data uploads and analysis

What are your expectations about the solution?

A real-time AI model capable of:

- Harmonising EO and sensor datasets
- Predicting CO₂ fluxes with ≥85% confidence
- Issuing control adjustments based on plant type, lifecycle, and ambient change
- Generating transparent, compliant GHG performance reports

A modular AI system (API or edge-based) with:

- Integrated sensor–EO pipelines
- Customisable greenhouse environment logic
- Real-time carbon reporting and anomaly alerts
- Optional link to MRV/carbon registries



Additional information?

Take Root Bio (TRB) is a UK-based space farming company developing modular, closed-loop agrifood systems for Earth and extraterrestrial applications. Our **TRB AgriFood EcoSystem** integrates aquaponics, fungi, dwarf trees, and precision agriculture within biocontainers designed for urban and off-planet deployment. We have developed a **prototype carbon monitoring system** to track greenhouse gas (GHG) flows within these controlled environments, supporting both optimisation of plant growth and alignment with MRV protocols for climate finance and sustainability reporting. This challenge builds on our commitment to net-zero food production and biosphere-level air quality control.

Information about the challenge ownership

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EVOLUTION OF CONCEPT

BIO - ORBITAL 1
Zero-G Autonomous Orbital
Growing lab for aquaponics/
hydroponics/ aeroponics.

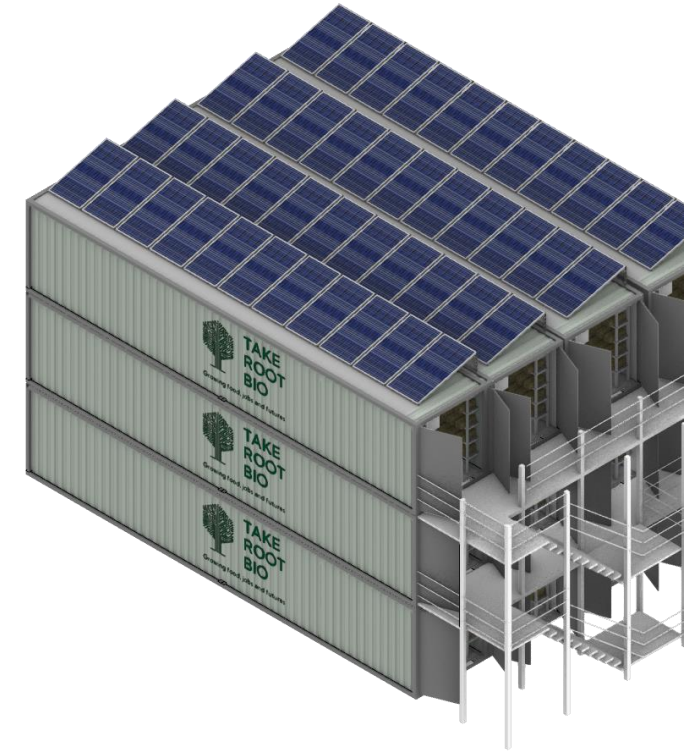
BIO - CONTAINER
Self sustained- mini facility
that can be remotely/
autonomously operated

BIO - UBN 1
Typology to be adaptable to
various urban structures

INDUSTRIAL BIO-SITE

Special large-scale projects with unique
resource potential such as abundant wind,
water deposits, recyclable materials,
vintage sturdy structures etc.

This facility (named "Old Forge", is a
practical rconversion of a derelict surface
structure to form a comprehensive vertical
farming facility and eventually, a packing/
sortation and distribution hub for the mine
located below.



Our TRB BioContainer prototype is being developed to
support harsh environment and humanitarian aid locations
as our system is designed to 'grow' a complete diet.



Take Root Bio