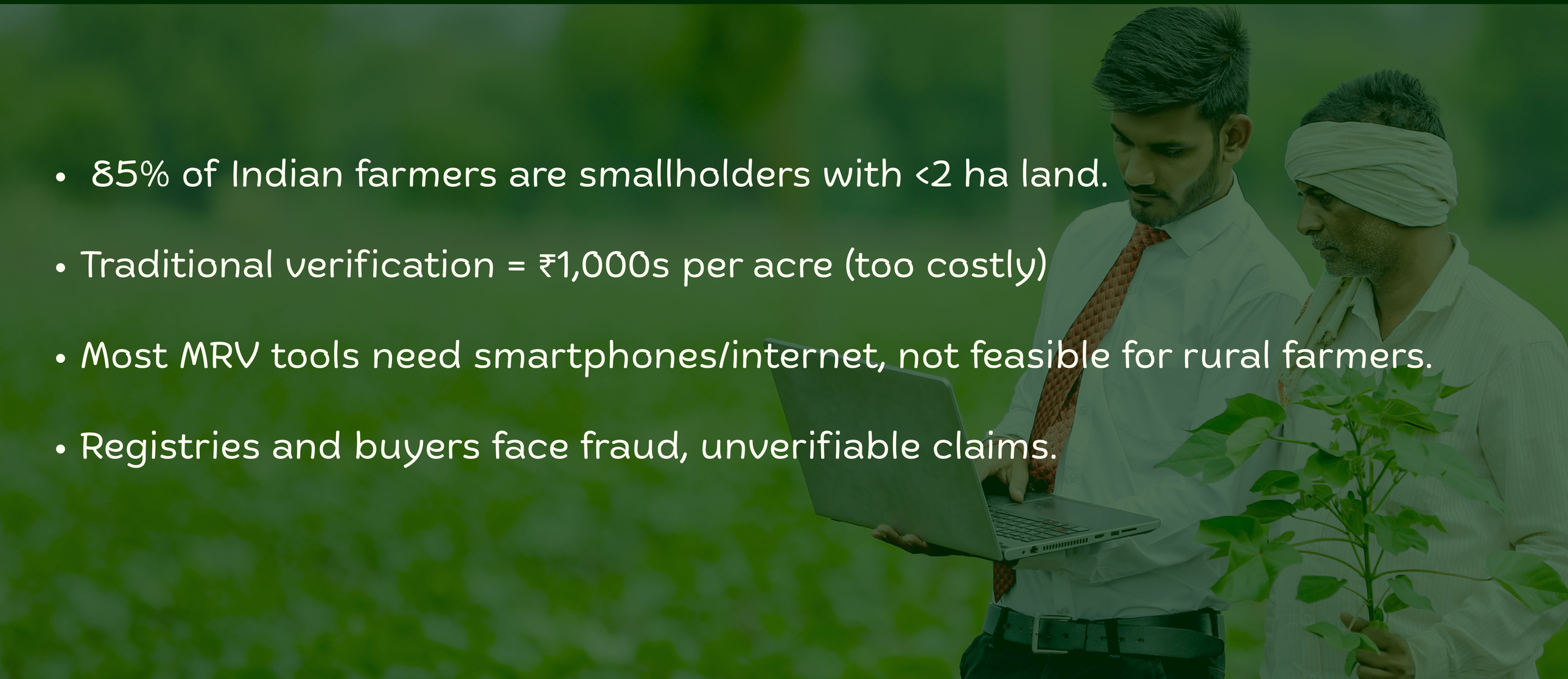
CarbonSetu

A bridge to carbon markets

The Challenge for Small Farmers in Carbon Markets



- 85% of Indian farmers are smallholders with <2 ha land.
- Traditional verification = ₹1,000s per acre (too costly)
- Most MRV tools need smartphones/internet, not feasible for rural farmers.
- Registries and buyers face fraud, unverifiable claims.

Contents

- Voice-based IVR system
- Satellite verification
- AI-powered calculators
- Automated credit generation
- Farmer dashboards & reports

Voice Based IVR System

- Farmers report sowing dates, irrigation practices, or tree planting using a simple phone call in their local language.
- No smartphone or internet required
- SMS fallback for confirmation/updates.

- The entire conversation is recorded and converted into text to speech. Using GenAI fetch the relevant information, process it and store it in database.

or

- An AI agent can be build to collect information which will be textual and stored in database

Satellite Verification

(Low-cost, Transparent)

1. **Rice: Sentinel-1 SAR tracks flooding vs drying cycles:**

- Satellite checks if rice fields are always flooded or if farmers practice alternate wetting & drying (AWD).

- Detects flooded fields which shows distinct backscatter signature (low VV, stable VH).

- **Time-series analysis** detects alternate wetting & drying (AWD) vs continuous flooding. Identifies number of flooded days and drying periods.

What we measure for each field:

- Flooded days – how long the field stayed under water.
- Drying periods – how many times the field dried.
- Farming practice – Continuous Flooding / AWD / Direct Seeding. up to 40% methane reduction compared to continuous flooding.

Satellite Verification

(Low-cost, Transparent)

2. Agroforestry:

- Satellite monitors tree growth over time (green cover, canopy spread). Vegetation indices (NDVI, EVI, Red-edge bands) capture canopy density, greenness, and tree health.

- Can show if trees planted by farmers are growing well and absorbing CO_2.

- Detects canopy fraction (0–1), tree density (via calibration). Estimates above-ground biomass, converts to CO_2 stock using allometric equations.

What we measure for each plot:

- % Tree cover (how much of the farm is shaded by trees).
- Tree density (approx. number of trees).
- Carbon stored (tons of CO_2 absorbed).

AI Powered Calculators

1. Rice (using Sentinel-1 Radar)

- Input: Radar Images (Sentinel-1 SAR). Every 6 days, satellites send radar images. Each pixel = a number showing backscatter strength.

- Backscatter = the strength of the signal that bounces back to the satellite. Which depends on what's on the ground:

    - **flooded field = smooth surface = radar signal bounces away = low backscatter (dark pixels).**
    - **Dry soil or plants = rough surface = radar signal scatters back = high backscatter (bright pixels).**

- Based on this, **Time Series ML model** can be trained on to backscatter values to classify each plot into:
    - **Continuous Flooding**
    - **AWD**
    - **Direct Seeded Rice**

- **Output:** % of time flooded, number of drying cycles, final practice classification

Credits = (Baseline Methane − Project Methane) × 27

AI Powered Calculators

2. Agroforestry (using Sentinel-2 Optical)

- Input: Optical images from Sentinel-2. Every 5 days.
- Each pixel = light reflectance values (different bands: Red, NIR, Red-Edge).

- **What does reflectance mean?**
  - Healthy green leaves absorb red light (for photosynthesis) and reflect near-infrared, high NDVI (bright green pixels).
  - Bare soil / dry land reflects both red & NIR similarly, low NDVI (brown pixels).
  - Dense canopy also changes red-edge reflectance, helps measure leaf density.

Bigger canopy = heavier tree = more biomass

Carbon = 0.5 × Biomass

CO2e = Carbon ×3.67

Build a AI model which:

- Looks at satellite indices (NDVI, EVI, Red-Edge) to measure tree health, canopy cover, height & density.
- Learns how leaf area and canopy growth relate to tree size.
- Uses scientific formulas (allometry) to convert canopy into biomass and from that convert to carbon stock.

Automated Credit Generation

- System automatically converts CO_2 savings into carbon credits using registry-approved methods. Every ton of CO_2 reduced/removed = 1 verified carbon credit.
- Built-in safety deductions (e.g., 10–20%) and risk buffers ensure compliance.
- Creates digital audit trails, Each credit is linked to satellite data + farmer records. Creates a transparent ledger that buyers and regulators can cross-check anytime.

Farmer Dashboards & Reports

- Farmer-level reports in local language (PDF/print) saying “You saved X CO_2, you earn ₹Y.”
- Community/FPO dashboards which contains: Interactive maps showing farm plots + aggregated credits
- Builds trust by showing the full chain: CO_2 saved → credits → income.

Architecture

Using python library (Whisper)

or

OpenAI API

Store practice information

Farmer Enrolment (IVR)

Speech To Text (STT)

Data Collection

Clean Data (NLP / LLM)

Satellite APIs

AI Model Training

Classification

Carbon Calculations

Credit Generation

Reporting

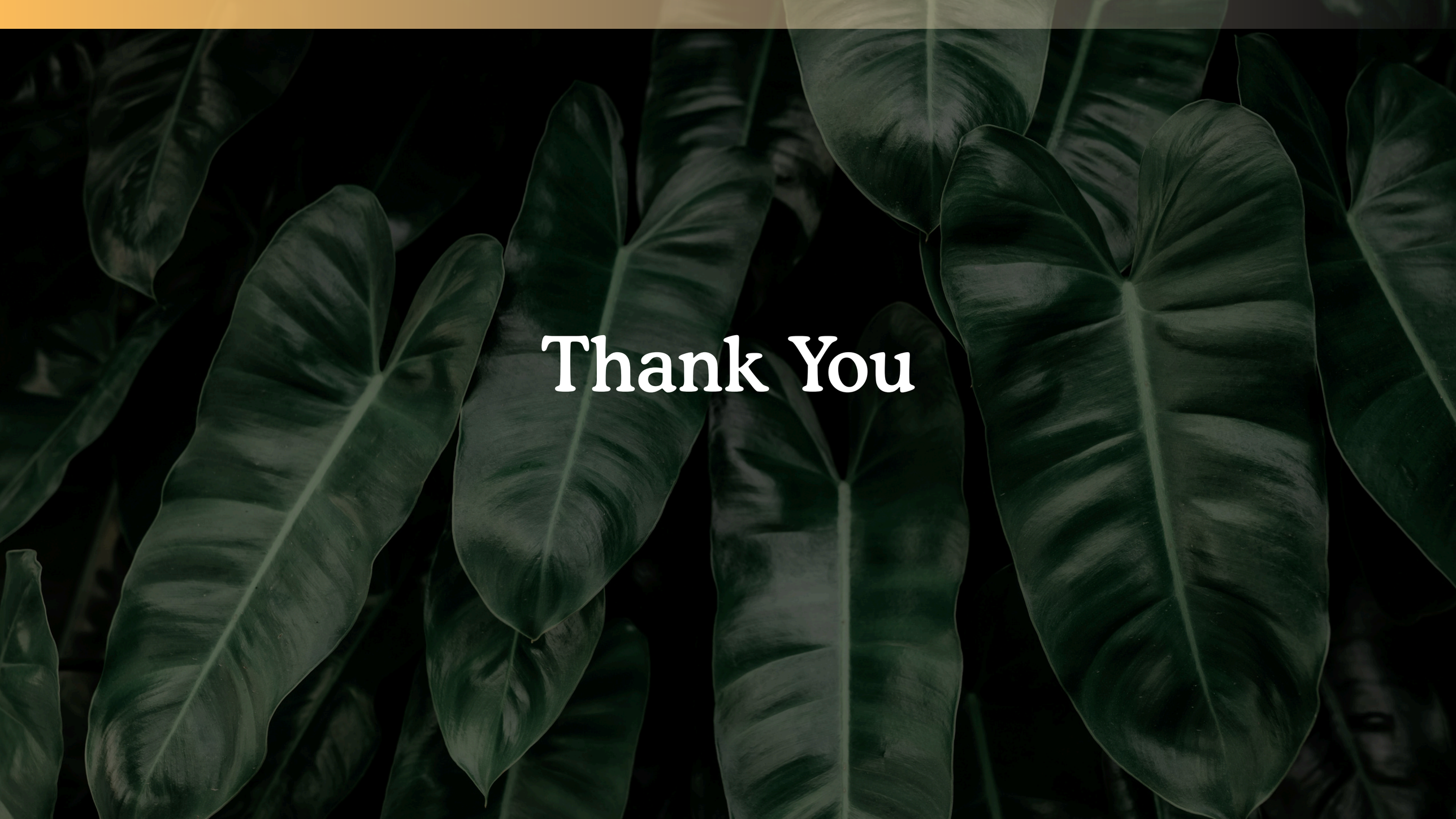
Registry Integration

Payment & Benefits

Scaling & Monitoring

Time Series for Rice

Decision Tree Model for Agroforestry data


Thank You