Revealing yield drivers in Sulawesi cocoa agroforestry: The primacy of farm management over shade effects

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Can cocoa farms simultaneously boost yields while mitigating climate change?

Importance

Cocoa agroforestry (CAFS) is a promising nature-based solution,...

- It can **improve crop yields, ecosystem services,** and **income**.
- There is a **high diversity** of cocoa agroforestry systems (CAFS) and **contextual drivers**.

BUT

However, there are key gaps to realize CAFS strategies.

- **Impacts** of shade trees **on cocoa yield** remain uncertain.
- **CAFS typologies** must be identified and characterized.
- **Agroforestry strategies** should be **tailored** to local contexts.

Objectives

- To characterize CAFS typologies
- To understand yield determinants
- To evaluate strategies for improving yield and carbon

Methods

Data: 200 farms in Sulawesi, Indonesia

- Farmer surveys
- Vegetation assessment
- Pod counting

Analysis:

- Vegetation structure, carbon stocks, greenhouse gas emissions analysis
- Generalized Linear Models to assess yield determinants

Results

1. Four cocoa agroforestry typologies were identified

Boundary planting contributed significantly to carbon stocks

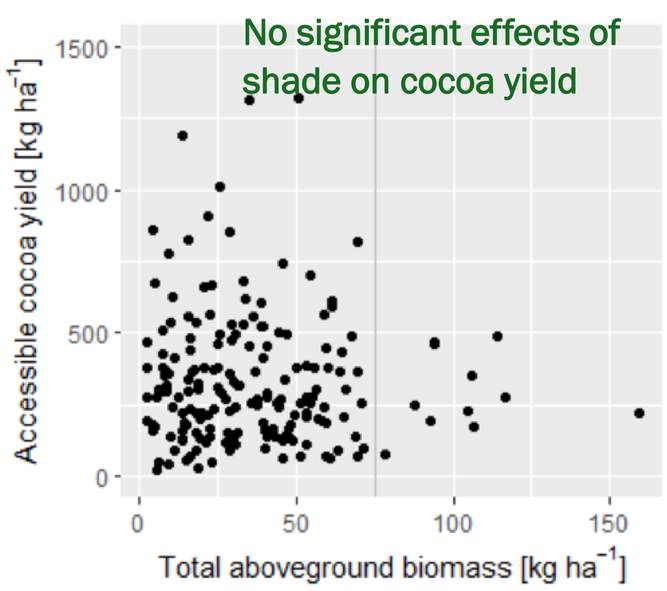
Innovative sampling strategies

- Separate sampling for **boundary** and **associated** (on farm) trees
- Number of sampling plots depends on farm size

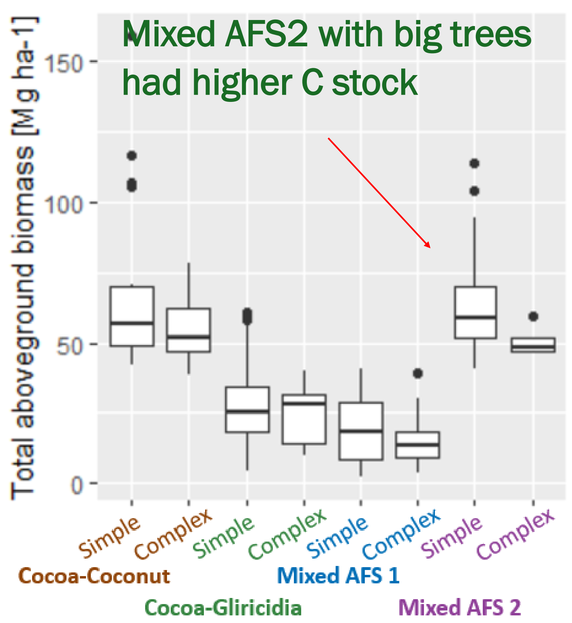
2. Key cocoa yield drivers

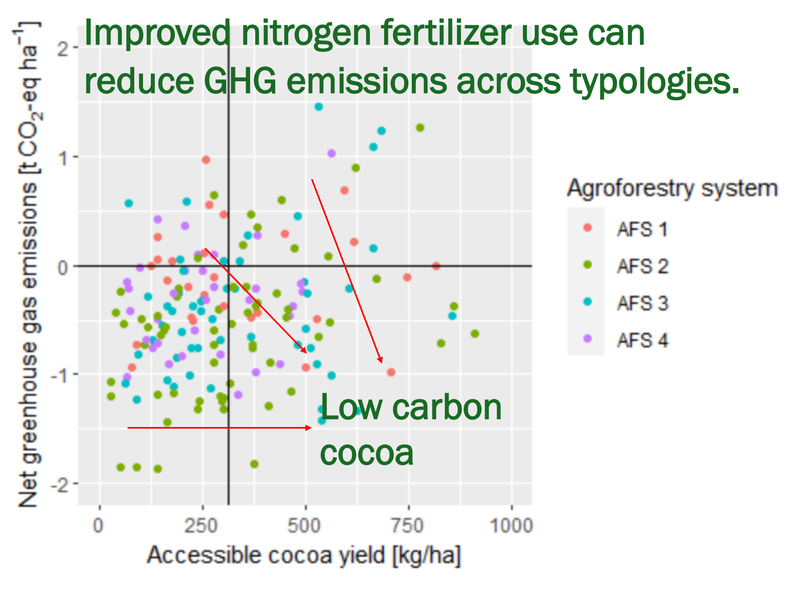
Significant yield determinants

- Number of productive cocoa trees
- Combination of clones
- Pruning practices
- Insecticide and fertilizer effectiveness only observed with pruning



3. Carbon stocks and GHG emissions





Recommendations

High carbon stock CAFS

- Gradually **replace unproductive cocoa**
- Plant **big trees** along **boundaries** and maintain 30-40% shade level on-farm

Low carbon emissions CAFS

- **Adequate pruning** improves **nitrogen use efficiency** and reduces emission

Impact/Take-away

- ✓ **Effective management practices** are more critical for boosting cocoa yields than shade effects.
- ✓ **Tailored, site-specific recommendations** are essential to improve CAFS performance.
- ✓ **New methods** and **context-driven, on-farm data collection** are key for advancing cocoa strategies.

What's next?

- Devise insights from top-performing farms with high yield and good carbon balance
- Adapt methods to local contexts
- Create databases for tree traits, apply vegetation modeling, validate with experts, and participatory implementation with farmers

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