CRC 990
Ecological and Socioeconomic Functions of Tropical Lowland Rainforest Transformation Systems Sumatra, Indonesia

AO4

Stock, turnover and functions of C in heavily weathered soils under Tropical lowland RTS

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Introduction

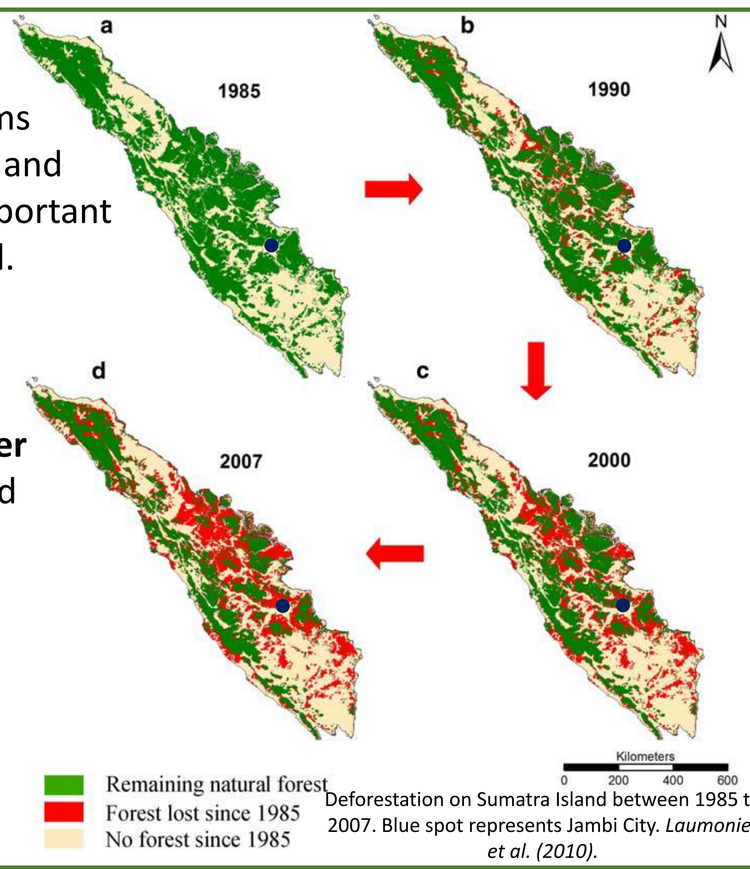
Land-use changes in tropical ecosystems lead to major modifications of soil properties and processes, especially soil organic carbon (SOC); an important soil fertility parameter in heavily weathered soil.

Objectives

Identifying and quantifying **impacts** of transformation systems (TS): **oil palm** (O), **rubber** (R) and **jungle rubber** (J) plantations **on SOC** quality, turnover and stocks, and so, on soil fertility and functions.

Hypothesis

Land-use change modify **not only C stock and budget,** but also DOM production and water consumption by vegetation, leading to a **relocation of C in the subsoil**.

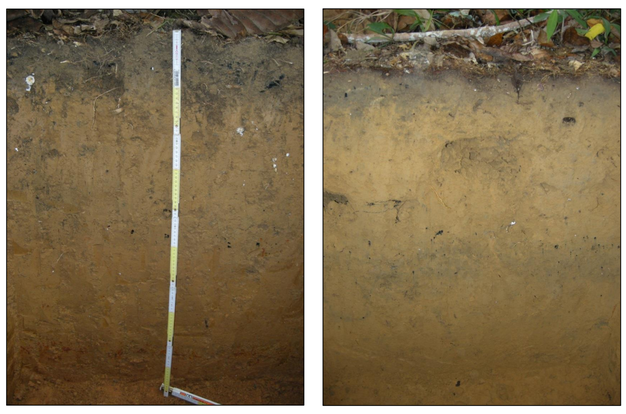


Deforestation on Sumatra Island between 1985 to 2007. Blue spot represents Jambi City. *Laumonier et al. (2010).*

Methods

Study sites

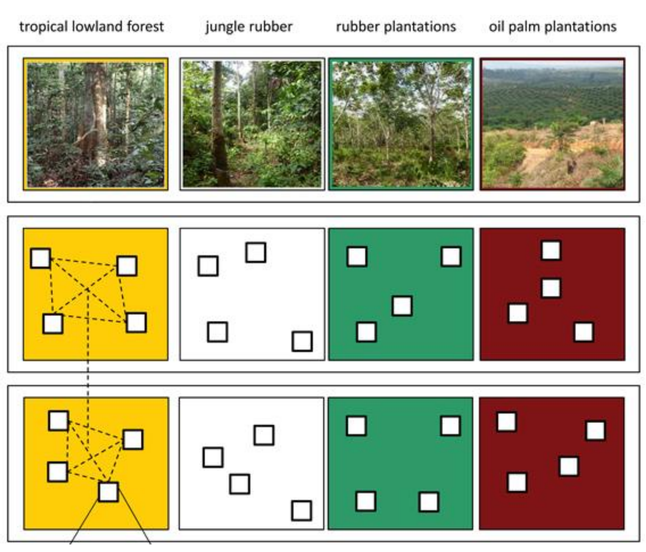
The TS investigated, including lowland rainforest (F) as reference sites, are located in Jambi Province (Sumatra).



2 Soils illustrating texture´s variations. **left** : ULTISOL, clayish, showing strong eluviation/illuviation process of clay and iron oxides; **Right**: INCEPTISOL, sandy with little expression of pedogenetic processes

Sampling

Follows CRC 990 general design. Soils have been described and sampled per horizon on 4 replicates of each TS in 2 different regions (32 sites).



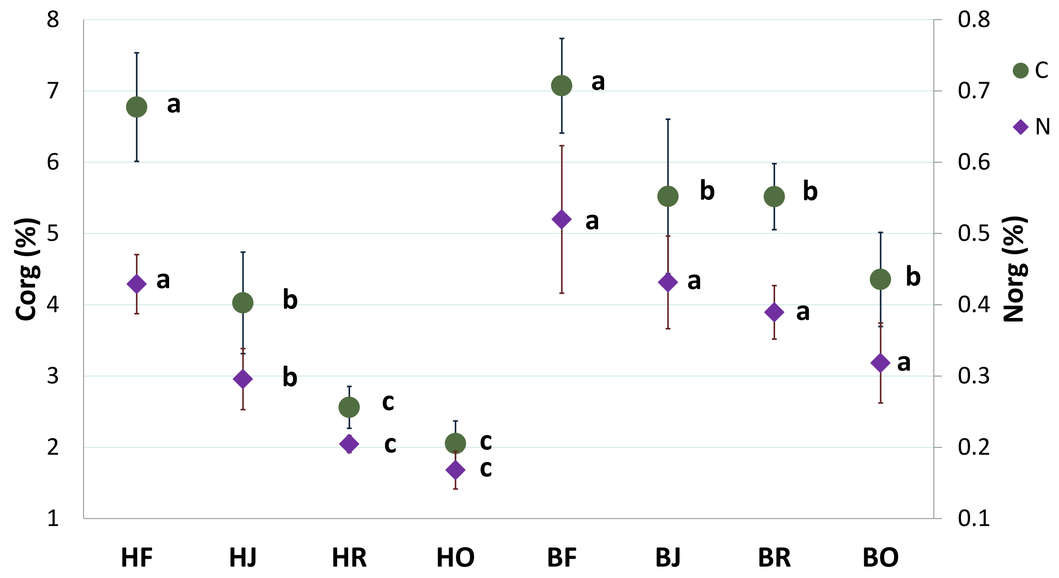
Design of the CRC 990 core plots common for all a and b group subprojects.*CRC 990 Founding proposal (2011).*

Results

1. Assessment of changes in stocks, quality and stability of C

E1) Effect of land-use & region on C - N (%) in A horizon

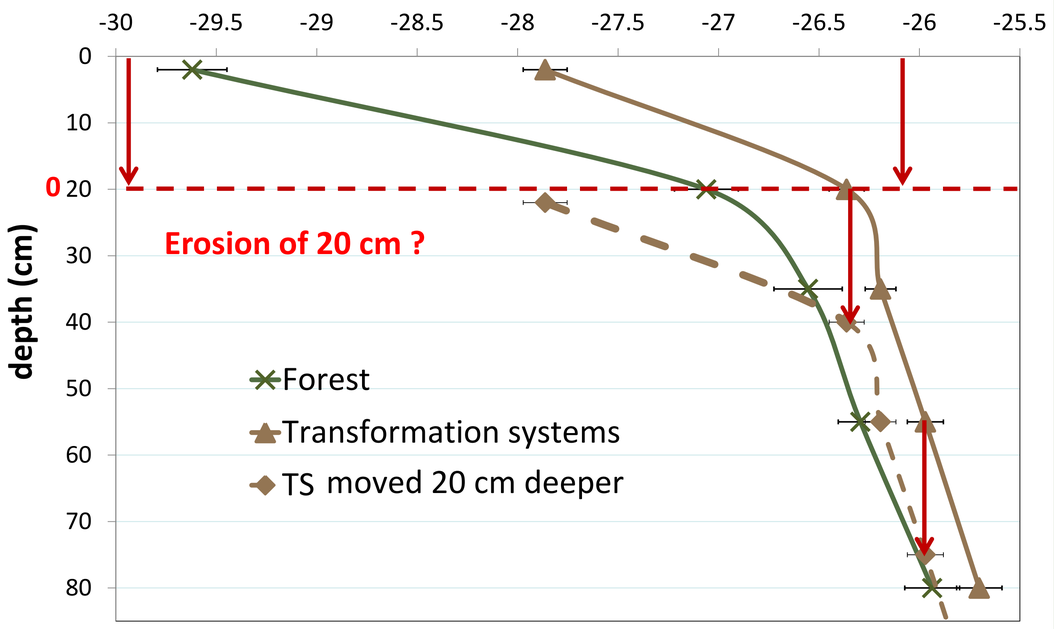
E2) Effect of land-use less pronounced in Bukit region



Data from A horizons. H: Harapan region, B: Bukit region, F: Forest, J: Jungle rubber, R: Rubber, O: Oil palm. Error bars represent standard error. Different letters indicate significant difference ($p<0.05$) according to planned comparisons (F vs JRO, J vs RO, R vs O) of ANOVA.

Why ?

E1) Erosion?



Planned work

E1) Changes in C balance?

Biological stability
- Long term incubation

VS

Thermal stability
- Pyrolysis Rock-Eval

Chemical stability
- FTIR on extracted OM?

Spatially induced stability
- Density fractionation
- Macroaggregate stability

E2) Differences in soil characteristics?
- **Texture**
- **Type of clay**

E2) Differences of management ?
- **Age of the plantation**

2. Mechanisms and processes of C sequestration in top and subsoil

DOM Flux

1 year biweekly measurement
• CRC 990 provides:
-> Meteorological data, SWC, sap flow,…

Sorption capacity

sorption experiments

3. Changes of functions of stored C for soil fertility

Microbial biomass

Soil fumigation

Exo-enzyme activities

Cellobiohydrolase / chitinase...