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# Towards the agroecological management of rubber plantations: insights from research works in Thailand and Ivory Coast

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# What agroecology (AE) is?

“Agroecology is an **alternative to intensive agriculture** based on the artificialization of crops through the use of synthetic inputs (fertilizers, pesticides, etc.) and fossil fuels. It promotes agricultural production systems which **value biological diversity and natural processes** ”

<https://dicoagroecologie.fr/en/homepage-english/>



<https://www.agroecology-pool.org/agroecology/>

# Moving to agroecology: transition rather than revolution



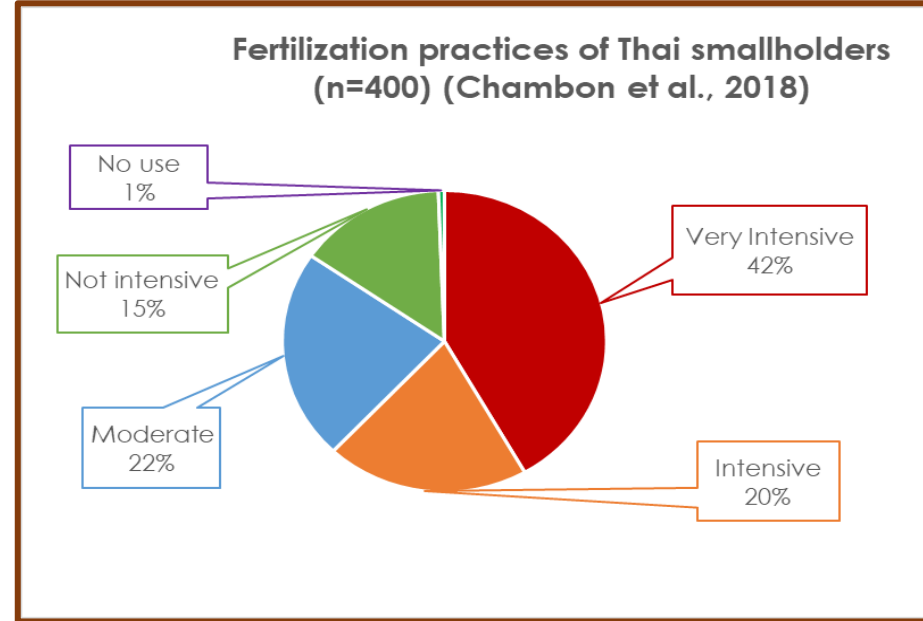
## **Sri Lanka's organic revolution hits farmers hard**

By Sophie Landrin (New Delhi (India), correspondent)

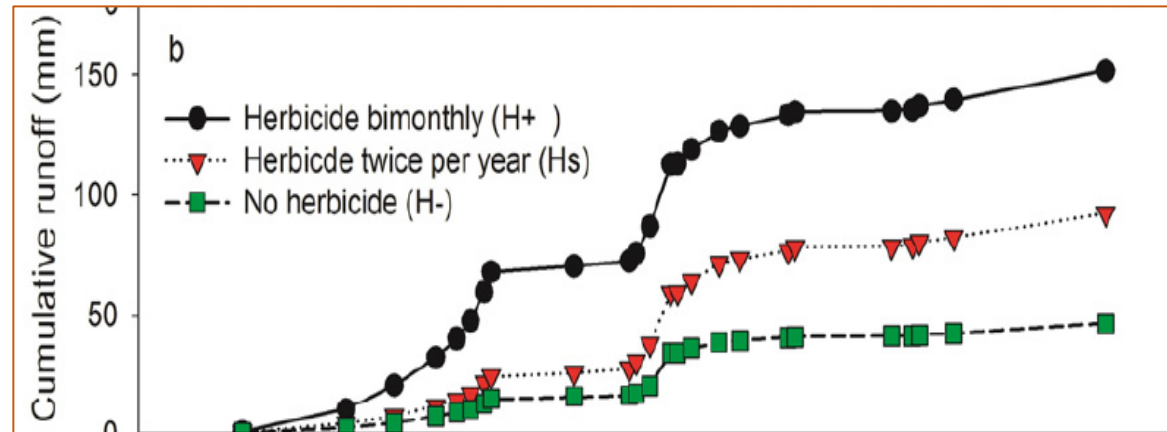
Published on June 14, 2022 at 03h17, updated at 07h44 on June 14, 2022



# Agroecological issues in Rubber Plantations: Excessive use of Chemicals



- NPK fertilizers and herbicides (glyphosate)
- Mainly during immature phase
- Excessive use and environmental impacts reported in the literature








Impact of herbicide application on soil erosion and induced carbon loss in a rubber plantation of Southwest China

Hongxi Liu<sup>a</sup>, Sergey Blagodatsky<sup>a,b,\*</sup>, Marcus Giese<sup>a</sup>, Feng Liu<sup>c</sup>, Jianchu Xu<sup>d</sup>, Georg Cadisch<sup>a</sup>

# Agroecological issues in Rubber Plantations: Replanting

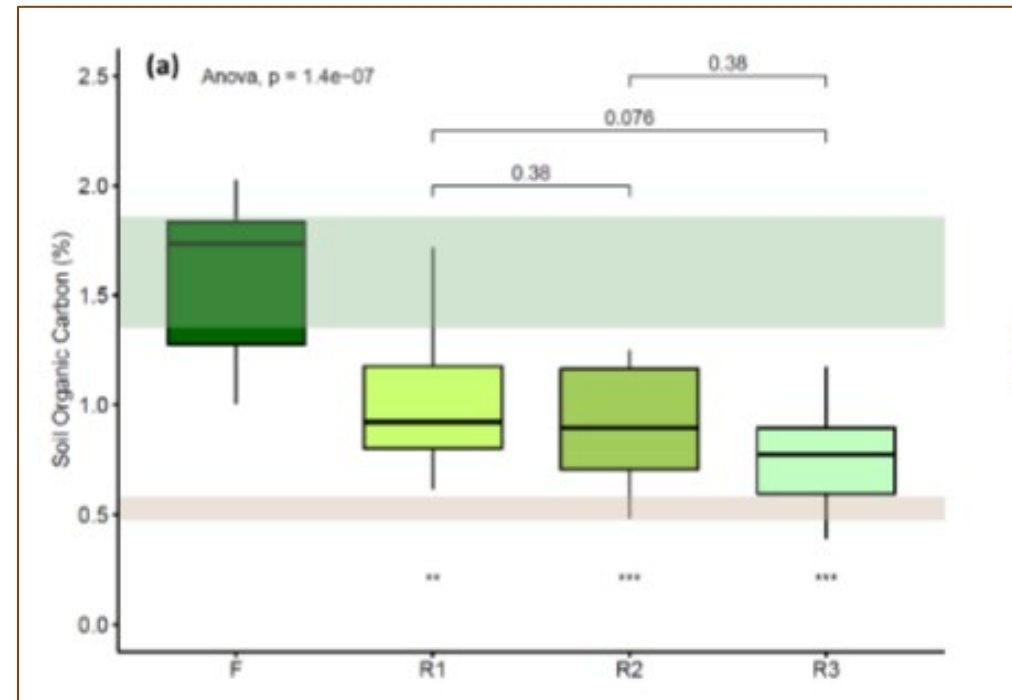


## Rubber, rubber and rubber: How 75 years of successive rubber plantation rotations affect topsoil quality?

Phantip Panklang<sup>1,2</sup> | Alexis Thoumazeau<sup>3,4,5</sup>  | Rawee Chiarawipa<sup>1</sup> |  
Sayan Sdoodee<sup>1</sup> | David Sebag<sup>6,7</sup>  | Frédéric Gay<sup>3,4</sup>  | Philippe Thaler<sup>8,9</sup>  |  
Alain Brauman<sup>8</sup> 

Replanting is a critical phase  
for sustainable soil  
management

How to improve replanting  
practices?



# Agroecological nutrient management of rubber plantations

(RE)-PLANTING



IMMATURE



MATURE

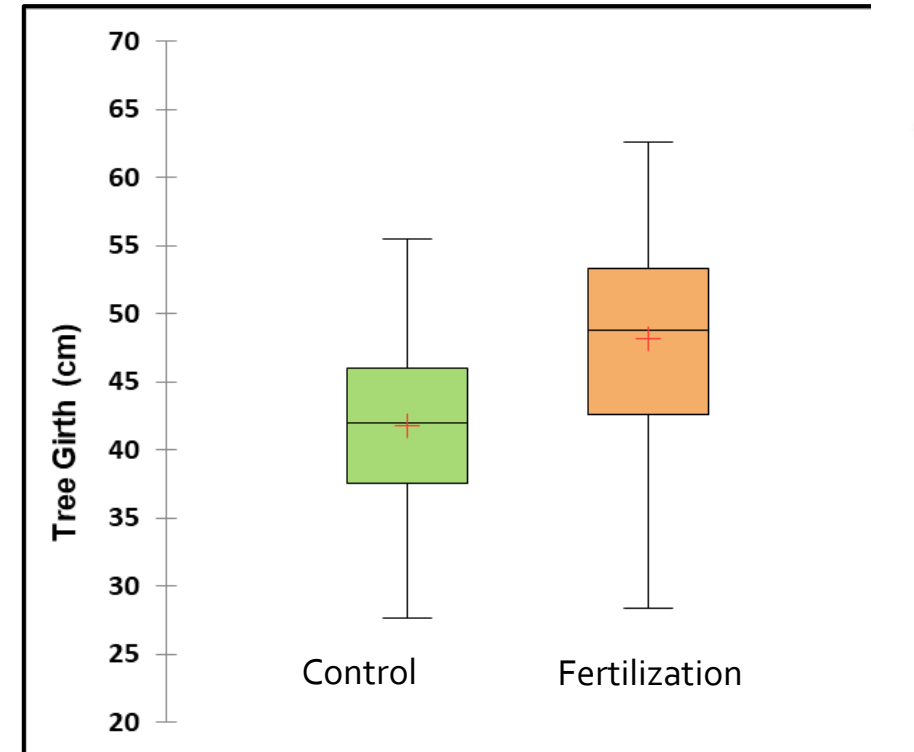
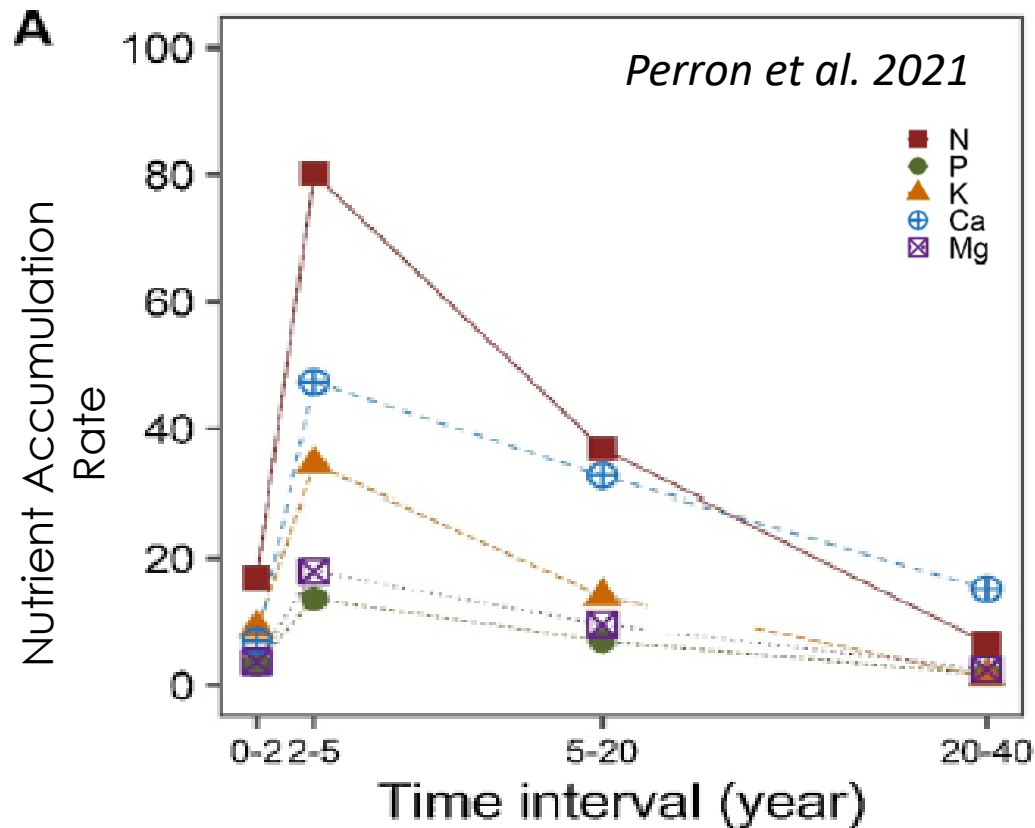


Knowing nutrient requirements  
of rubber trees to better  
manage fertilization practices

Sustainable  
management  
of soil health

# Knowing nutrient requirements to better manage fertilization practices

## Immature phase (0-6 YAP)



- Peak of nutrient accumulation 2-5 YAP (*Perron et al, 2021*)
- Strong effect on growth (15-50%) (*Vrignon-Brenas et al., 2020; Mak et al, 2022*)



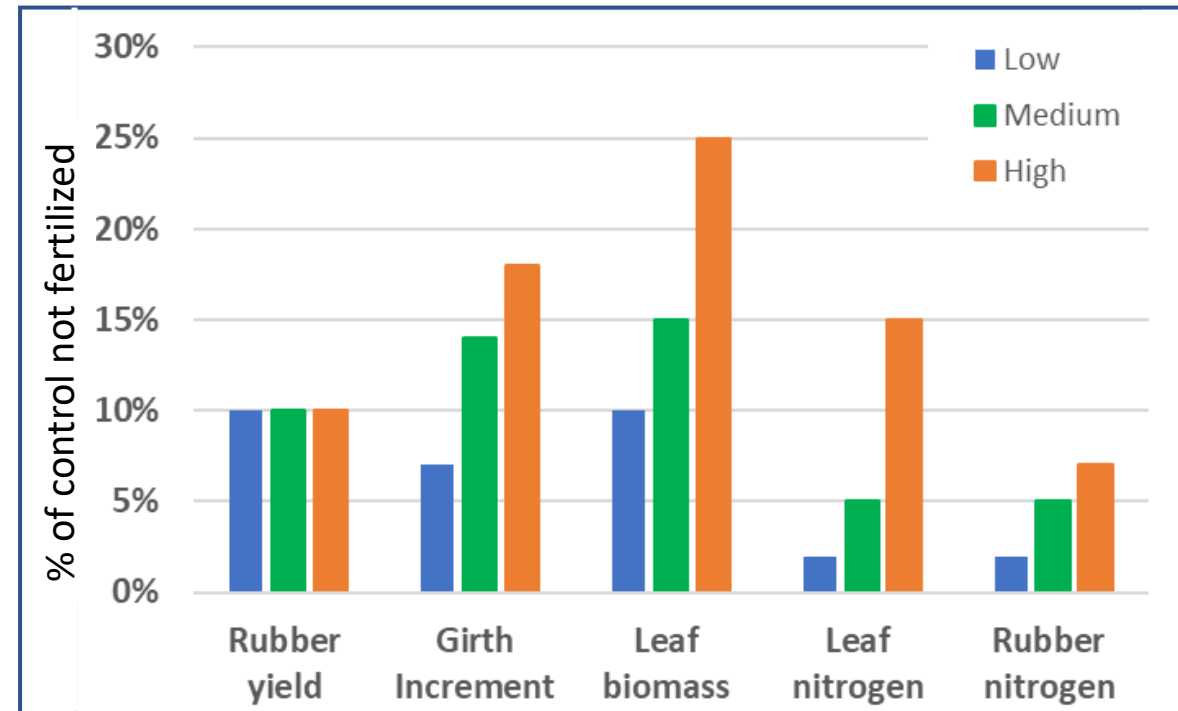
# Knowing nutrient requirements to better manage fertilization practices

mature phase (7-30 > YAP)



Weight of each element exuded in latex (kg/ha /year)			
	N	P	K
Control	15.3	4.0	10.5
Low	17.0	4.4	11.4
Medium	16.7	4.4	11.3
High	17.7	4.5	11.9

*Vaysse et al. unpub.*



*Gay et al. unpub.*

- Low Nutrient Accumulation Rate and Low nutrient export
- Effect on yield limited to 10% but long-term effect on whole tree functioning

# How to assess soil health?

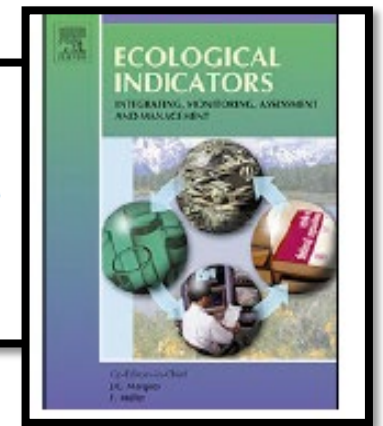
“The capacity of soils to function and provide ecosystem services”

(Karlen et al., 1997; Walter et al. 2015)

Ecological Indicators 97 (2019) 100–110

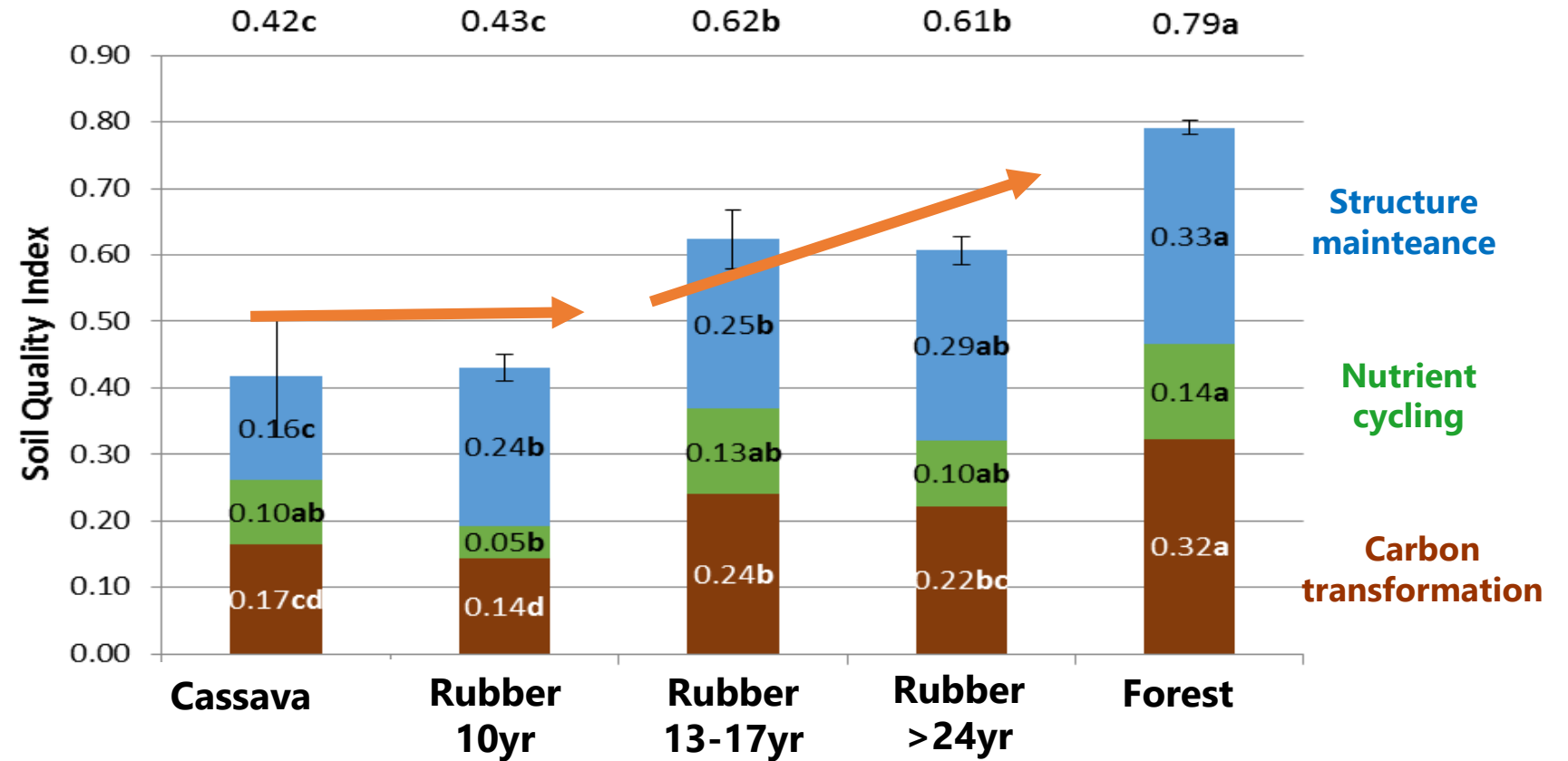
Biofunctool®: a new framework to assess the impact of land management on soil quality. Part A: concept and validation of the set of indicators

Alexis Thoumazeau<sup>a,b,c,d,\*</sup>, Cécile Bessou<sup>a</sup>, Marie-Sophie Renevier<sup>b,d,e</sup>, Jean Trap<sup>b</sup>,



- **Conceptual** framework based on Kibblewhite et al., 2008;
- **3 functions** linked to assemblages of soil organisms
- **9** low-costs, in-field indicators
- Aggregation into one **Soil Quality Index (SQI)**

# Soil health dynamic of a rubber plantation

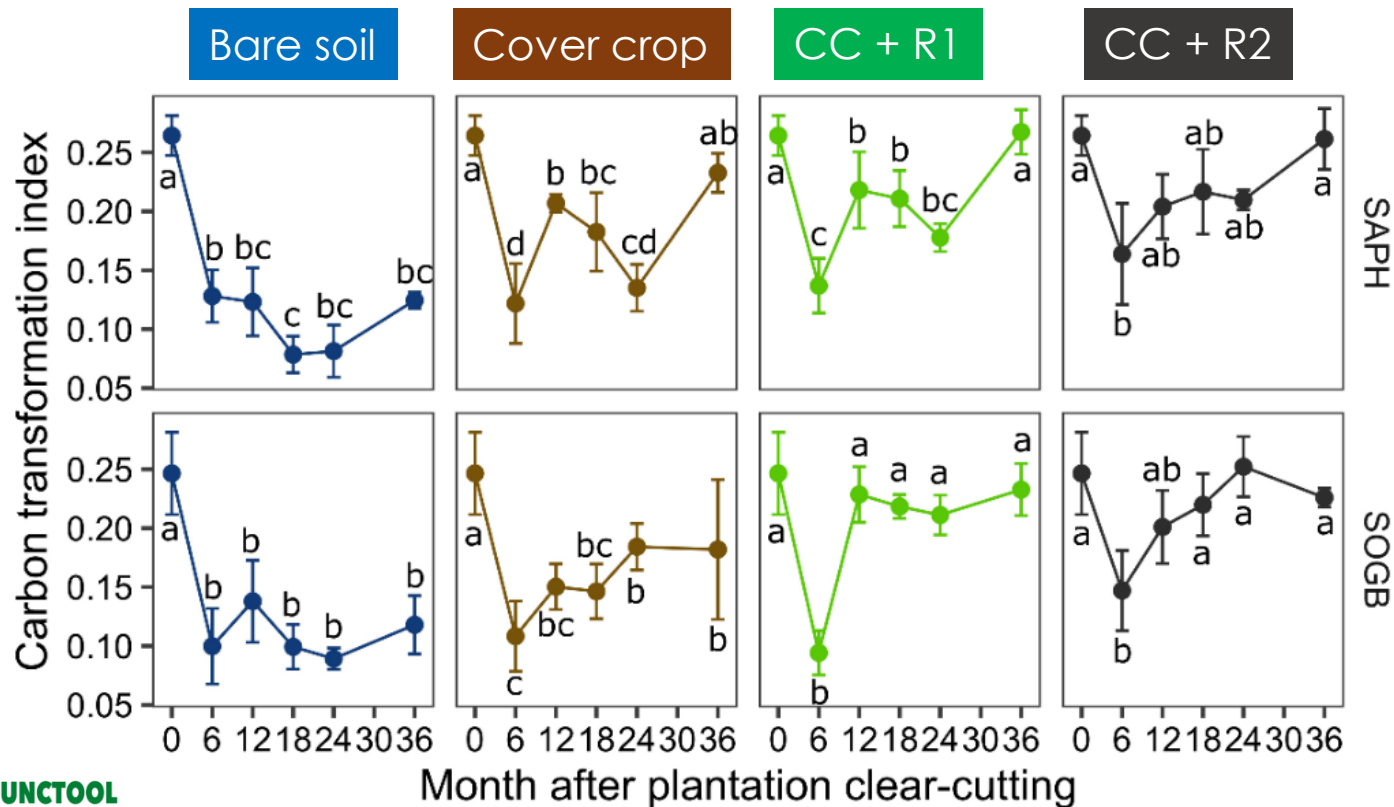


- Immature phase: **low soil quality**, depend on the previous land use
- Mature phase: **improvement** of soil functions with time

# How to restore soil health after replanting?

Logging residues promote rapid restoration of soil health after clear-cutting of rubber plantations at two sites with contrasting soils in Africa

Thibaut Perron<sup>a,b,c,d,\*</sup>, Aymard Kouakou<sup>e,f</sup>, Charlotte Simon<sup>e</sup>, Louis Mareschal<sup>c,e</sup>, Frédéric Gay<sup>a,b</sup>, Mouman Soumahoro<sup>d</sup>, Daouda Kouassi<sup>g</sup>, Nancy Rakotondrazafy<sup>e</sup>, Bruno Rapidel<sup>a,b</sup>, Jean-Paul Laclau<sup>c,e</sup>, Alain Brauman<sup>e</sup>



R1



R2



Leaving the logging residues in the plot between the tree lines enables soil restoration.



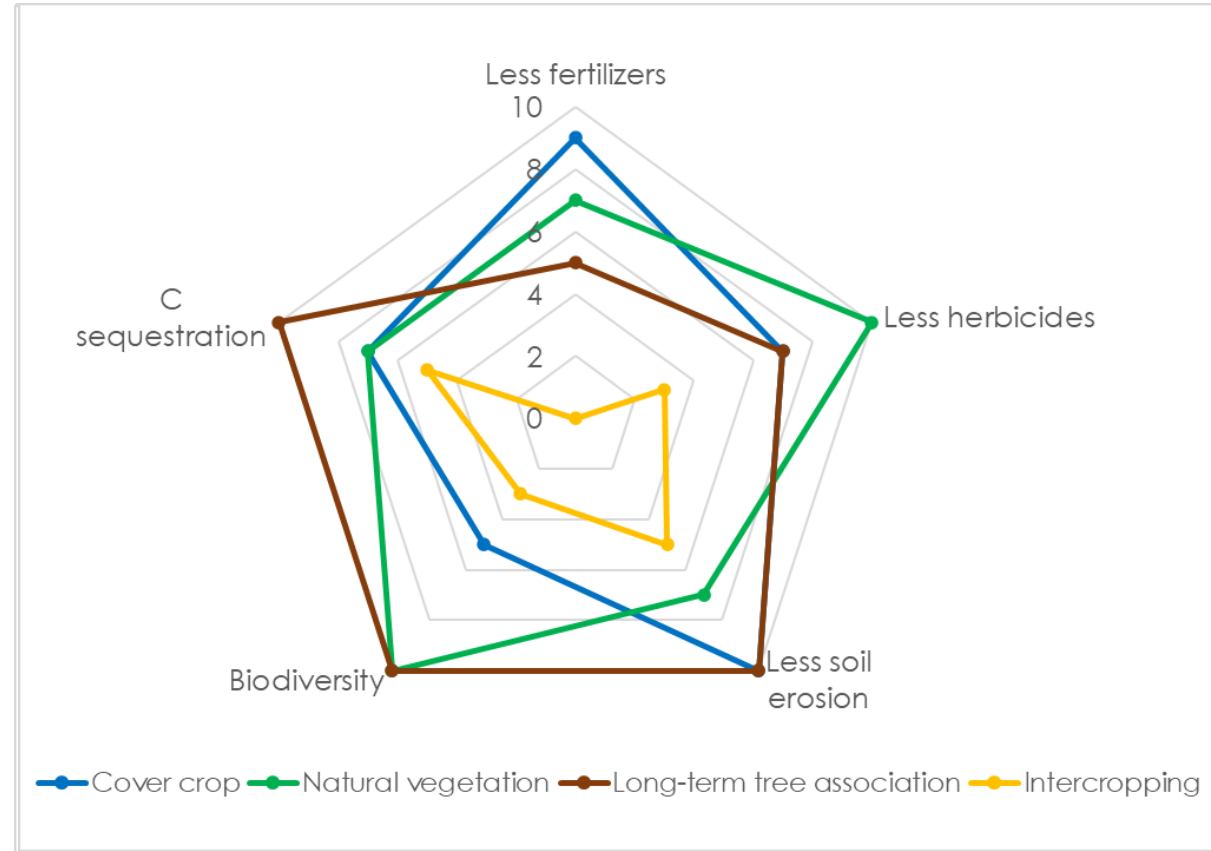
# Rubber Agroforestry Systems: necessarily agroecological?



Natural vegetation



Cover crop



➤ Importance of multicriteria approach

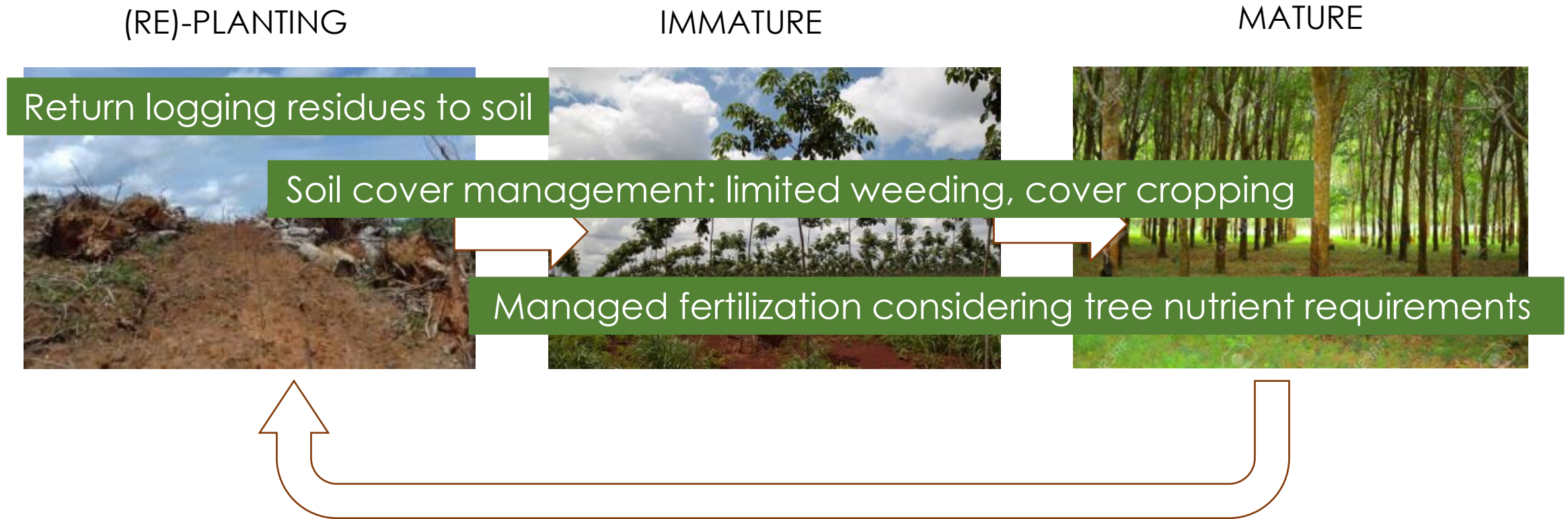


Tree association



Intercropping

# Take Home Messages: Good Agroecological Practices?



❖ **Agroecology transition needs time:** the longer plantation lifespan, the better → “long-term” tapping systems

# Acknowledgments

- « **Towards the sustainability of rubber production in Thailand** », Thai International Cooperation Agency /HRPP
- **HEVEADAPT « How tree-based family farms can adapt to global changes? »**, French National Research Agency (ANR)
- « **Fertilization of Mature Rubber Plantation** », Yara International
- « **Fertilization and fertility of immature rubber plantation** », « **Hevea Biodiversity** » French Rubber Institute (IFC), SOCFIN, SIPH, Michelin company

