

RUBBERFLUX: An *in natura* platform to study carbon and water cycles in Rubber tree plantations

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Why studying rubber plantations?

- **Natural Rubber** is a biopolymer produced by millions of small farmers which is essential for high-value-added industrial sectors (mainly tire industry).
- **Harvesting of latex by tapping** creates an artificial carbon sink that completely modifies the whole carbon allocation pattern of the trees.
- High demand for NR has triggered the **expansion of rubber plantations** in marginal areas with adverse climate (drought, cold) and soil (poor fertility) conditions, and has induced **land use changes** with possible detrimental environmental (deforestation) and social impacts.

Impact of climate on C allocation and plantation productivity

A network of **3 flux tower sites** along a rainfall gradient (TICA and Heveadapt projects)

1/ Chachoengsao site

Set-up in 2007

Main PI: F.Gay, Cirad

2/ Bueng Kan site

Set-up in 2012

Main PI: J.Pattarlerphong, Kasetsart University

3/ Nakhon Si Thammarat site

Set-up in 2015

Main PI: C.Chayawat, Kasetsart University,

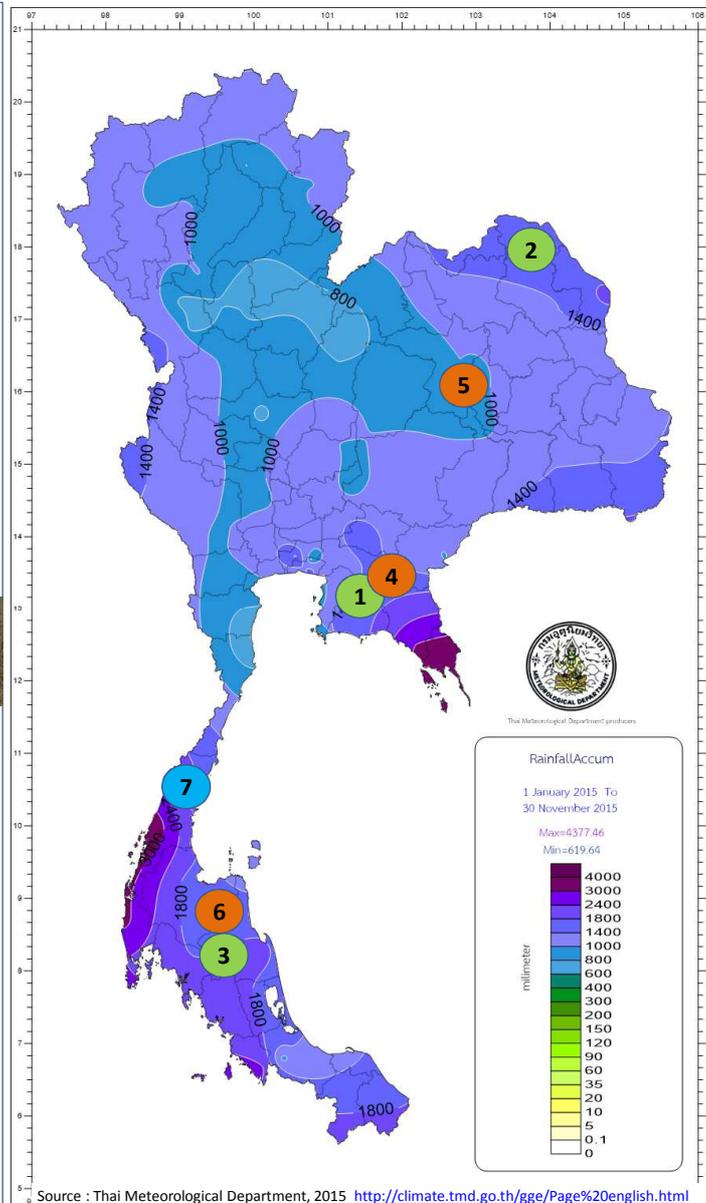


Continuous/automatic measurements

- CO₂ et H₂O flux (eddy covariance)
- Micro-meteorological variables (T°, HR, Rainfall, Wind speed, Rg, Rn, PAR)
- Water content and temperature soil profiles
- Sap flow

Spot measurements

- Aboveground and belowground NPP: stand inventory, litter fall, fine root turnover, latex yield, LAI
- Soil respiration
- Natural abundance of ¹³C in leaves and latex



Impact of rubber plantations on soil biodiversity

3 **networks of farmers' plantations** + a **soil microbiology lab** in Bangkok (IFC Biodiv and Heveadapt projects)

4/ Chachoengsao province

Impact on SOC and soil biodiversity of cultivating rubber trees after intensive cassava cultivation.

5/ Khon Kaen province

Impact of the intensification of management practices on soil biodiversity

6/ Surathani province

Impacts of replanting rubber trees on nutrient dynamics, soil biodiversity and NPP.



Impact of nutrient management on C allocation and plantation productivity

Large scale, long-term trial (10ha) with 4 levels of NPK fertilisation + 2 tapping system (Yara and Heveadapt projects)

7/ Bangburd site

Set-up in 2014

Main PI: F.Gay, Cirad

Experimental design: split-plot with 4 repetitions.

Main measurements: micro-climate, yield, NPP, LAI, soil water and nutrient dynamics (lysimeters)



Recent publications

- Kanpanon N., Kasemsap P., Thaler P., Kositsup B., Gay F., Lacote R., Epron D. 2015. Carbon isotope composition of latex does not reflect temporal variations of photosynthetic carbon isotope discrimination in rubber trees (*Hevea brasiliensis*). *Tree Physiology*, 10 p. <http://dx.doi.org/10.1093/treephys/tpv070>
- Chairungsee N, Gay F, Thaler P, Kasemsap P, Thanisawanyangkura S, Chantuma A and Jourdan C (2013) Impact of tapping and soil water status on fine root dynamics in a rubber tree plantation in Thailand. *Front. Plant Sci.* 4:538. doi: 10.3389/fpls.2013.00538
- Satakun, D., Gay, F., Chairungsee, A., Kasemsap, P., Chantuma, P., Thanisawanyangkura, S., Thaler, P., Epron, D. 2013. Soil CO₂ efflux and soil carbon balance of a tropical rubber plantation. *Ecological Research*, DOI 10.1007/s11284-013-1079-0

The Heveadapt project (ANR 2014-2017) How tree-based family farms can adapt to global changes? Agronomists, socio-economists, ecologists and soil scientists are mobilized to assess the sustainability of rubber tree smallholdings. contact philippe.thaler@cirad.fr

