

COFFEE-FLUX (Costa Rica): observatory for monitoring and modeling carbon, nutrients, water and sediment ecosystem services in coffee agroforestry systems; mitigation and adaptation to climate changes through ecosystem manipulation

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COFFEE-FLUX (Costa Rica)

Observatory for **monitoring** and **modeling** carbon, nutrients, water and sediment ecosystem services in coffee agroforestry systems;

Mitigation and adaptation to climate changes through **ecosystem manipulation**

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Coffee-Flux(1): a SOERE F-ORE-T(2) Observatory of biophysical research on coffee agroforestry systems

Sites:

-Aquiares-Turrialba = wet site (Yield, NPP, C-fluxes, manipulation of Shade x Fertilization, N_2O fluxes, SOM deep stocks, hydrology, sediments)

-Llano Bonito-Tarrazu = dry site (yield, agronomy, hydrology, sediments)

-CATIE-Turrialba = wet site: long-term manipulation of Shade x Fertilization : yield, microclimate, profitability, labour.

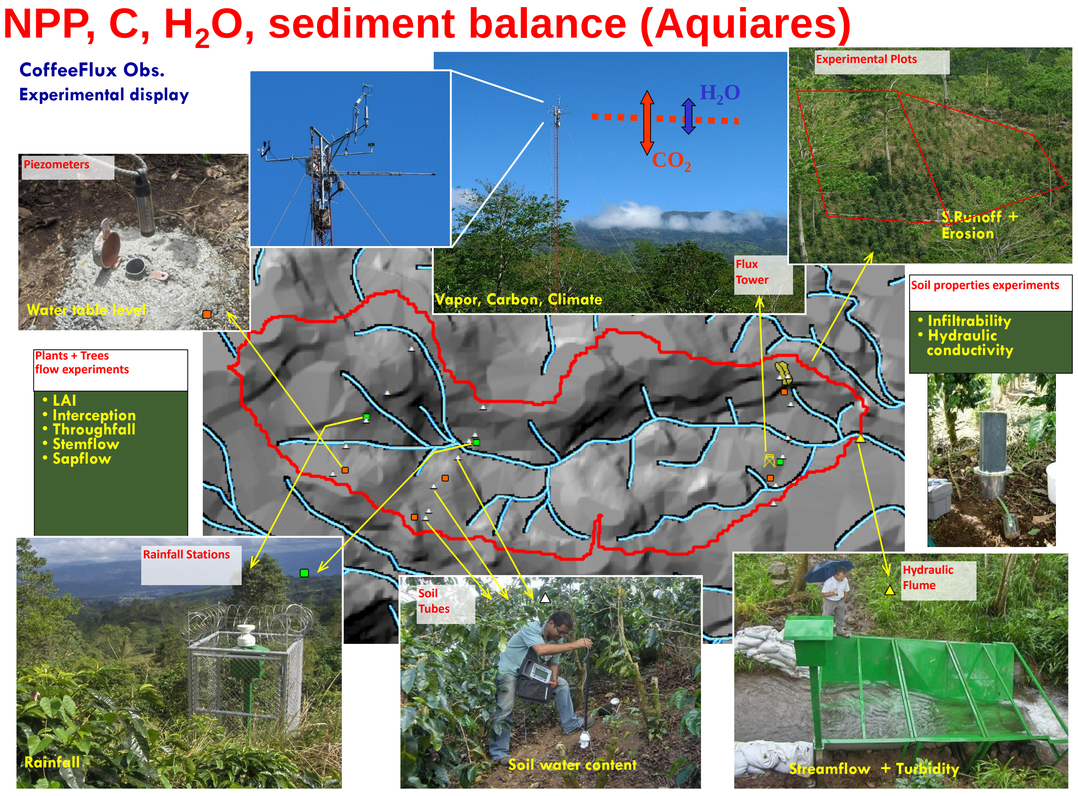
Modeling:

-MAESPA: a plot model for plant-to-plot scale energy, C and H2O balance

-MACACC-GO+ and CAF2007: plot models for yield, ecosystem services

-Hydro-SVAT: watershed lumped hydrological and SVAT model

NPP, C, H_2O, sediment balance (Aquiares)



Kinoshita R, Roupsard O, Chevallier T, Albrecht A, Taugourdeau S, Ahmed Z, van Es HM. 2016. Large topsoil organic carbon variability is controlled by Andisol , properties and effectively assessed by VNIR spectroscopy in a coffee agroforestry system of Costa Rica. Geoderma, 262: 254-265.

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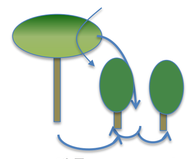
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Manipulation of Shade x Fertilization (Aquiares)

- 4 nitrogen fertilization levels: 50, 110, 170, 230 kg N/ha/y
- Shade tree: *Erythrina poeppigiana* (N_2 fixer)
- 3 shade levels:

High shade | Pruned shade | No shade

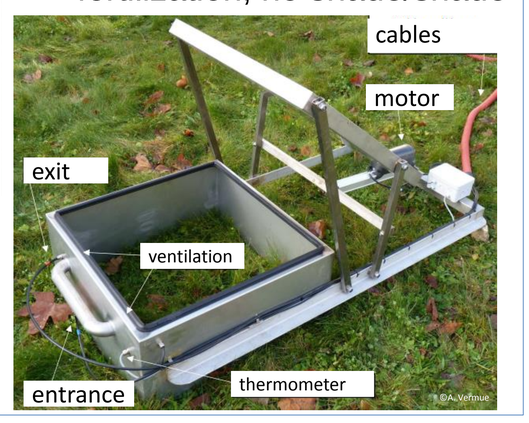




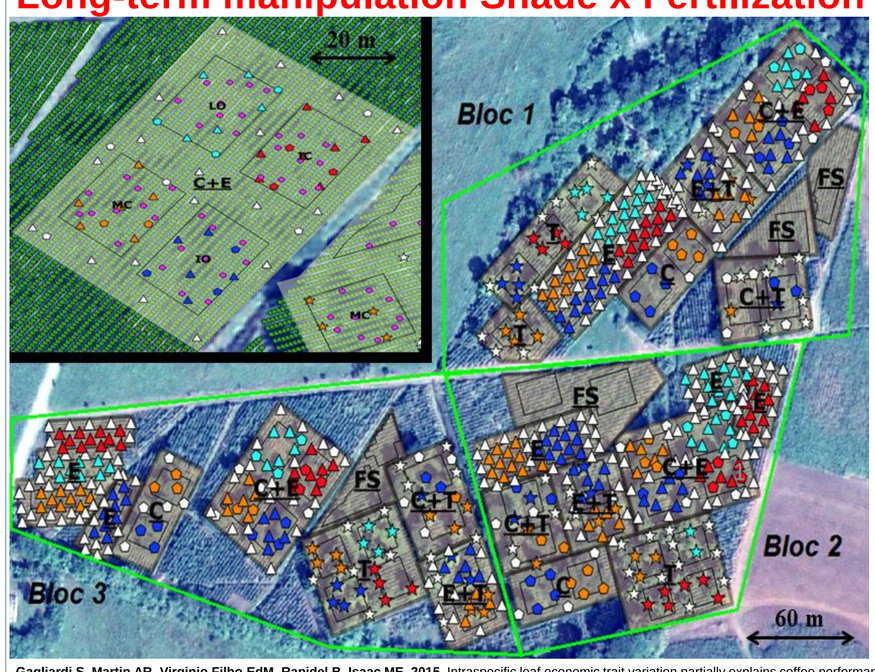
- Experiments:
  - Horizontal nitrogen fluxes (^{15}N enrichment)

- Measurements:
  - Soil & plant N status
  - Soil nitrate
  - N mineralization rates

- N2O emissions:
  - Automatic chambers
  - 3 treatments (low/high fertilization, no shade/shade



Long-term manipulation Shade x Fertilization (CATIE)



Split-plot design (9 ha):

-Main level: « Shade type » (tree species)

-Second level: « Management » (fertilization)

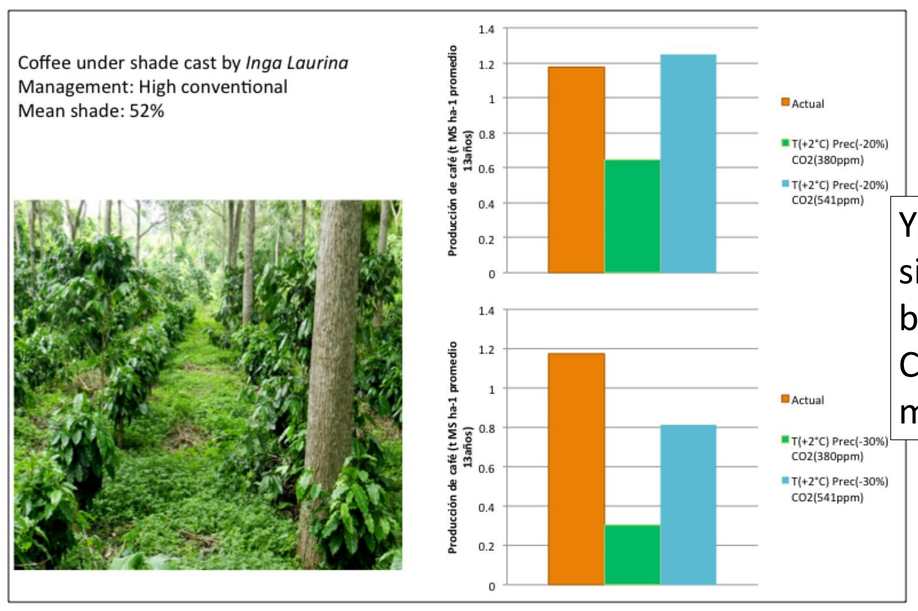
(source M. Soma)

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Schnabel F, De Melo Virginio Filho E, Xu S, Fisk I, Roupsard O, Haggar J. 2016. Agro-ecological interactions between types of shade and management in contrast to full sun and its i mplications in the development of coffee plants (Coffea arabica var. Caturra). In. Prep.

Yield, agronomy, hydrology, sediment (dry site)



Yield simulation by CAF2007 model

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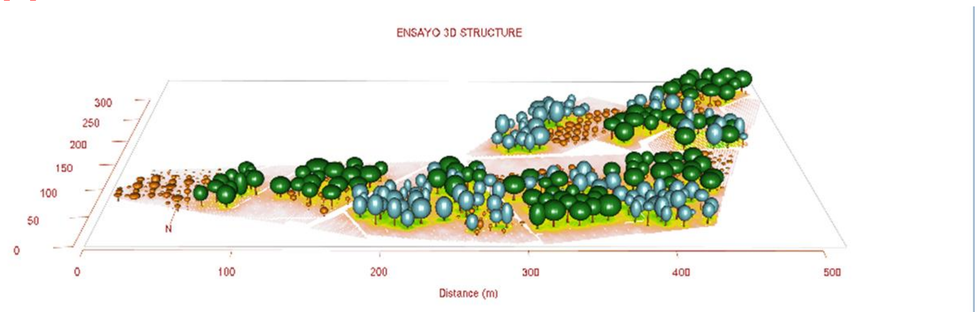
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Site intercomparison through Modeling

-Hydrological behaviour of 2 watersheds, wet and dry, under contrasting climate change projections: using Hydro-SVAT model

-Mitigation and adaptation of coffee: microclimate, yield and NPP behaviour according to Shade, Fertilization, under climate change projections : MAESPA, CAF2007 and MACACC-GO+ models (ANR-MACACC)

-Applications : NAMAs (Nationally Appropriate Mitigation Actions)



*Transmittance simulated by **MAESPA** in the coffee agroforestry trial (source PhD Rémi Vezy)*

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(1)Coffee-Flux website: http://www6.montpellier.inra.fr/ecosols/Recherche/Les-projets/CoffeeFlux

(2)Observatories SOERE F-ORE-T : http://www.allenvi.fr/groupes-transversaux/infrastructures-de-recherche/f-ore-t/%28language%29/fre-FR