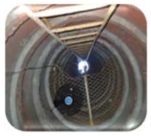
Publications in 2017

Germon *et al.* **Consequences of mixing *Acacia mangium* and *Eucalyptus grandis* trees on soil exploration by fine-roots down to a depth of 17 m**. Plant and Soil.

Lambais *et al*. **Contrasting phenology of *Eucalyptus grandis* fine roots in upper and very deep soil layers in Brazil**. Plant and Soil.



Oliveira *et al*. **Simulating the canopy reflectance of different Eucalypt genotypes with the DART 3D model**. Journal of Selected Topics in Applied Earth Observations and Remote Sensing.

Prudêncio de Araujo Pereira *et al*. **Distribution of bacterial communities through deep soil profiles in monospecific and mixed forests of *Eucalyptus grandis* and *Acacia mangium* in Brazil**. Plos One.

Projects in progress

Characterizing and predicting biomass production in sugarcane and eucalyptus plantations in Brazil (2016-2019).
Funding FAPESP – Microsoft Research (Brazil)

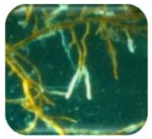
Monitoring carbon, water and energy cycles in a clonal Eucalyptus plantation in Brazil; EUCFlux 2 (2017-2026).
Funding IPEF and private companies (Brazil)

Climate change and energy efficiency in agriculture: a focus on water stress, organic management and soil biology (2017-2021).
Funding Fapesp (Brazil)

What biological mechanisms link biodiversity to tropical forest functioning? A tree experiment in Brazil (2018-2019).
Funding Cemeb (France)

Important figures

Cirad researchers in Brazil: 3
Cirad researchers involved: 8
Brazilian researchers involved: 10



From 2016 to 2017
French and Brazilian phD students: 6
Number of projects: 9
Number of articles: 14
Number of congress communications: 12

Private research supports

IPEF
SUZANO
DURATEX
CENIBRA
Fibria
Klabin
INTERNATIONAL PAPER

National and international networks

AnaEE
CVT AllEnvi
SOERE
Système d'Observation et d'Expérimentation, sur le long terme, pour la Recherche en Environnement
F-ORE-T
Fonctionnement des écosystèmes forestiers
ECOFOR
ECOSYSTEMES FORESTIERS

Contact (France Team)

Dr. Agnès Robin (Cirad, UMR Eco&Sol)
Visiting researcher ESALQ-USP Department of Soil Sciences
agnes.robin@cirad.fr
Tel: +55 (19) 99668-2539 / +33 06 70 62 93 25
http://www.umr-ecosols.fr/en/

Cirad, UMR Eco&Sols, 2 place Viala, Bâtiment 12, 34860 Montpellier, France

Contact (Brazil team)

Pr. José Leonardo de Moraes Gonçalves (ESALQ-USP)
Department of Forestry
jlmgonca@usp.br
Tel: +55 (19) 2105-8644 / (19) 2105-8685
http://www.lcf.esalq.usp.br/

ESALQ-USP Avenida Pádua Dias, 11 – Piracicaba – SP- Brasil
CEP 13418-900

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unesp

Who are we?

The ORE "Forest Plantations" is a group of Brazilian and French researchers involved in a long-term collaboration **to improve our understanding of tree functioning and forest biogeochemical cycles**, and to provide scientific bases for the **ecological intensification of forest plantations** in the context of climate change.

To do so, we combine various fields of science in a **multidisciplinary approach** that include ecophysiology, remote-sensing, modelling, root ecology, soil ecology and biochemistry.

Partners of the ORE "Forest Plantations" aims to foster **scientific cooperation around forest plantations** by leading common research projects, training students and teaching academic and professional courses.

Most of our study sites are located in the **USP-ESALQ experimental station of Itatinga** (São Paulo State, Brazil).

Why study forest plantations?

Although plantations represent only a very small share of the current global forest area, they fulfil an increasing part of the human's wood needs and **supply a range of important ecosystem services**.

Tree planting is a crucial tool in the **context of afforestation, reforestation and forest restoration**, allowing to recover forest-like ecosystems and to alleviate pressure on natural forests.

Forest plantations are simpler than naturel forests and allow multi-factorial experimental designs, making it crucial to study the biological mechanisms that underlie tree and forest ecosystem functioning.

Our main objectives

- To improve our understanding of the biological mechanisms that underlie the **carbon, water and nutrient cycles in forest plantations** across time and spatial scales (from tree to landscape, from hour to decades) and down to very deep soil horizons.
- To provide science-based **silvicultural prescriptions** for the ecological intensifications of forest plantations and the reduction of their **environmental impacts** in the context of **climate change**.

Field experiments and observation sites

EUCFlux experiment
Carbon, water, energy and nutrient cycles is monitoring in a clonal Eucalypt plantation. More than 8 years of data are now available. The project also includes clonal tests, in order to evaluate the universality of the results obtained at the site.

Rainfall reduction x fertilization experiment
The influence of water and nutrient availability on primary productivity of Eucalypt plantation is evaluated. Two deep permanent pits were installed to monitor the root dynamic and the production of greenhouse gases (GHG) down to 17 m. Since 2016, the second rotation is conducted in coppice.

Harvest residues management experiment
The impact of the removal of forest residues and non-fertilization on tree growth, nutrient cycling, and soil functioning in eucalyptus plantation is studied. Comparisons are made with temperate systems to identify microbial indicators associated with the management of organic matter.

Eucalyptus/Acacia experiments
The functioning of mixed plantations of *Eucalyptus grandis* - *Acacia mangium* is studied: competition (water, light, nutrients) / facilitation (symbiotic fixation, nitrogen transfer...). Similar experiments have been set up in the Mato Grosso and the Tocanthins to evaluate the influence of soil and climatic conditions.

Genotype x fertilization experiment
This experiment was set up by the UNESP university (Botucatu, SP). The main objective is to define an ideotype of Eucalyptus, characterized by higher nutrient use efficiency (focusing on N, P, and K nutrients) to maintain sustainable production in the context of environmental changes.

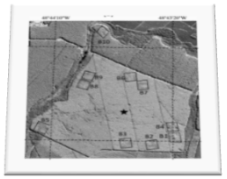
Native tree diversity experiment
A native tree diversity gradient experiment that aims to study the biological mechanisms underlying biodiversity-ecosystem functioning relationship in the Mata Atlântica biome et to provide scientific bases for forest restoration projects.

Multidisciplinary research

Ecophysiology

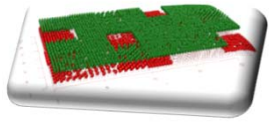
- Carbon, water and energy cycles (Eddy-covariance technique)
- GHG measurement (CH_4, N_2O, CO_2)
- Tree water, nutrient and light-use efficiencies
- Leaf physiology
- Biomass allocation and growth
- Root dynamic and mortality (minirhizotrons)
- Root and leaf traits

Remote sensing



- Structural (LAI) or biochemical (Chlorophyll) canopy characteristics
- Biomass estimations
- Very high remote sensing for tree counting and early mortality assessments
- Data assimilation in models

Modelling



- Simulation of the carbon and water cycles in forest plantations
- Development of process-based models (e.g., MAESPA, G'DAY)
- Complementarity with field measurements
- Upscale site level knowledge to regional scales

Nutrient cycling

- Soil nutrient availability
- Tree nutrient adsorption based on isotopic tracers (N_{15}, Sr, Rb, Ba)
- N_2 fixation
- Nutrient accumulation in trees and soil

Soil ecology

- Carbon sequestration
- Decomposition processes
- Bacterial and fungi biomass and diversity
- Microbial enzymatic activities
- Mycorrihzal symbiosis