

## DSCATT

### Dynamics of Soil Carbon Sequestration in Tropical and Temperate Agricultural systems

#### ABSTRACT

Questioned on the 4/1000 initiative on soil carbon (C) sequestration to face climate change (CC), several Labex Agro units and their partners propose to pull together their research capacities in order to provide new insights in soil C sequestration. The DSCATT project proposes to explore the potential for sequestering C in cultivated soils, taking into account the sustainability of agricultural practices in the context of global changes.

DSCATT operates at 4 sites (in Senegal, Zimbabwe, Kenya, and France). The project addresses 3 interrelated scales, i.e field, farm and territory or village scale.

At field level, research focuses on how biomass production and soil C sequestration relate, in different soil and climate conditions. Two approaches complement each other. One studies at the soil-plant interface the processes regulating the forms and residence time of C in soils. It includes the analysis of interactions between nutrients and C storage, the role of deep roots and in soils with contrasting storage potentials. The other approach determines the C balances under different practices.

Farms will be characterized in order to propose practices likely to improve complementarities amongst the activities of rural households. At this farm scale, DSCATT research will focus on farmers' practices (for crops, livestock, forestry...) and assess the impacts of farmers' practices on their objectives (income, food security...), taking into account their main constraints (cash, labour...). The project will assess the social and economic determinants of farmers' decisions and of trade-offs between farm activities.

At the territory (or farmers' network) level, the different compartments of agroecosystems and the organic matter flows will be studied. The project will analyze the role of the socio-economic and biophysical contexts and will test several possible changes and their impacts on soil C sequestration dynamics, economic performance of farms and food security.

This scientific knowledge and the viewpoints of the farmers involved will be shared and used for a transdisciplinary assessment of several C sequestration strategies in agricultural soils. Considering changes and uncertainties, a multi-criteria and prospective evaluation approach is proposed. It will allow iterations between evaluation and redefinition of strategies to cope with global changes in agriculture. The sharing and dissemination of the knowledge enriched by the project will target several audiences (farmers, students and teachers, policy makers) through a variety of communication media and assessment tools.

DSCATT will link the knowledge on processes governing the preservation of C sequestration and farmers' multiple objectives and constraints.

**Year :** 2018

**Project number :** 1802-001

**Type of funding :** PC

**Project type :** PE

**Research units in the network :** CEE-M SELMET SYSTEM

**Start date :** 2019-04-01

**End date :** 2023-03-31

**Flagship project :** no

**Project leader :** Dominique MASSE

**Project leader's institution :** IRD

**Project leader's RU :** ECO&SOLS GREEN AIDA

**Budget allocated :** 1000000 €

**Total budget allocated ( including co-financing ) :** 1700000 €

**Funding :** Labex

## GOAL

The overall goals of the project are

- to develop sustainable agricultural systems tailored for both higher productivity and higher C sequestration
- to raise awareness of the role of soil management for the mitigation of GHG emissions
- to assemble various research units from the Agropolis Foundations' scientific network and their partners in addressing major challenges with climatic change and food security.

The main research question is: What are effective and socially acceptable strategies to foster soil C sequestration in agricultural systems?

To answer to this question, we consider that:

- Efficient soil carbon sequestration (SCS), that is a net positive soil-plant systems C balance over a long period of time, can be achieved in ways that are economically, socially and environmentally sustainable and diffusible.
- The SCS strategies concern both farmers' practices at the field and farm level, and the local institutional arrangements, at the territory level.
- Prerequisites for farmers and local institutions to adopt SCS practices are: (i) the long-term soil C impact of present agricultural systems are known, (ii) technical changes or social arrangements enhancing SCS are identified and evaluated, (iii) social, economic and environmental impacts of targeted innovating SCS farmer practices or social arrangements are assessed.

Consequently, the following knowledge is needed:

- Long-term SCS dynamics and their determinants at the field, farm and landscape levels;
- Determinants of individual and collective capacity to adopt new practices over the long term;
- Indicators and tools helping multi-actors to assess and decide objectively the best strategies to intensify SCS;

The present project will identify and examine interactions between biophysical and socio-economic drivers and processes across the temporal and spatial scales to better understand the determinants and social and institutional conditions of adoption of soil C enhancing farming and institutional strategies. Studying processes and interactions implies transdisciplinary work using a conceptual social-ecological systems framework.

The DSCATT project will be carried out on 3 study sites in Sub Saharan Africa and 1 site in the mediterranean region of France.

Specific objectives:

- To quantify and analyze the soil C sequestration dynamics in different agricultural systems at the field, farm and territory scales
- To implement crop-soil, farm and landscape models to simulate long-term SCS
- To deliberate amongst stakeholders about soil carbon sequestration pathways
- To share knowledge to scale out and to scale up innovate methods or soil management options