Metaprogram
BIOSEFAIR

MODIMIR

THESIS

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Thematics involved
Plant and microbial ecology
Biogeochemistry
Modeling

Modeling the Effects of Microbial Diversity on the Regulation of Carbon and Nutrient Cycles in Agroecosystems

Backgrounds and challenges

The thesis aims to understand the impact of biodiversity loss on ecosystem services and to support the ecological transition of agriculture. To achieve this, it relies on a novel approach that models ecosystem multifunctionality, focusing on the synchrony between soil and plants. The objective is to identify the conditions and controlling factors (such as climate, soil, and species diversity) that govern ecosystem functioning. The research also includes both field and laboratory experiments to test these models.

Objectives

The goal is to understand how microbial and plant diversity, along with soil and climate conditions, influence carbon (C) and nitrogen (N) fluxes in diversified agroecosystems.

The specific objectives are as follows:

- Identify regulatory mechanisms: This involves detecting and describing the processes through which microbial and plant diversity control C and N cycles. In concrete terms, the research focuses on how different species interact to affect the availability and movement of these nutrients
- Develop conceptual models: Based on the mechanisms identified, the next step is to create theoretical models. These models will represent the complex interactions between biodiversity, soil, and climate, and how they influence nutrient fluxes.
- Validate models with experimental data: To ensure that the models are realistic and accurate, the thesis will use data from previous experiments as well as new measurements collected specifically for this research. This calibration and evaluation phase is crucial to confirm the relevance of the models.
- Assess different scenarios: Finally, the validated models will be used to simulate various scenarios. This will make it possible to evaluate the impact of different combinations of microbial and plant diversity, and soil-climatic conditions, on ecosystem multifunctionality. In other words, it will help predict how greater biodiversity can improve soil fertility or resilience to climate change.