



PhD student position

Modeling and assessment of the sustainability of bioeconomy scenarios in contrasting large-scale territories in France and Europe

SLAM-B project

As part of the FairCarboN program, the SLAM-B (<http://www.slamb.fr>) project aims to structure the French research community that develops and applies integrated assessment and modeling (IAM) approaches to support the development of a sustainable bioeconomy based on agroecology. SLAM-B focuses on the various components of the bioeconomy, including the diversity of production systems, raw materials and finished products, biorefineries, recycling loops, and supply chain organizations. SLAM-B aims to address three major scientific challenges: (1) developing generic IAM approaches to simulate bioeconomic transitions and anticipate their consequences by amplifying the functionalities of the MAELIA platform (2) demonstrating the relevance and legitimacy of these IAM approaches through their application within seven prospective Living Labs, called Scenario Labs, and (3) producing tailored knowledge for public decision-makers at the national and European levels. The proposed thesis work falls within this third area of SLAM-B.

Context and objectives of the thesis

France and the European Union's (EU) ambitions to achieve carbon neutrality by 2050 are based on reducing greenhouse gas (GHG) emissions and increasing carbon sinks. Agriculture, which is both a source and a sink of GHG emissions, is at the heart of national and European strategies that aim to replace fossil-based resources with renewable resources to fuel various bioeconomy sectors (e.g., energy production, molecules, materials), storing carbon in the soil (*carbon farming*), and adopting practices that limit the use of synthetic inputs (particularly nitrogen) and reduce emissions.

In this context, the overall objective of this thesis will be to model and evaluate the sustainability of bioeconomy scenarios in contrasting regions of France and Europe by 2050. The specific objectives will be to (1) define scenarios incorporating different levels of evolution of existing cropping systems and sectors using plant biomass (particularly biogas production), (2) implementing a modeling chain integrating the STICS soil-plant-atmosphere model at regional scales, and (3) assess the sustainability of the simulated scenarios. The multi-criteria assessment of this sustainability could be based on criteria relating to (i) food and energy biomass production, (ii) agro-environmental factors: impacts on soil carbon storage and soil fertility, nitrogen losses and the GHG balance of the agricultural areas studied, and (iii) the nitrogen autonomy of the territories. This thesis will thus enable the quantification, using a detailed modeling approach applied at the European level, of different production potentials and their short- and long-term impacts, and the evaluation and identification of scenarios and associated trade-offs that would enable the agricultural sector to cope with various food, energy, and environmental production challenges.

Training and skills:

- Recommended education: master's degree in agronomy, environmental science or ecology.
- Recommended knowledge: knowledge of cropping systems, water, nitrogen and carbon cycles, analysis and handling of large data sets.
- Relevant experience: use of crop models, biomass conversion processes.
- Required skills: ability to work in a team, written and oral communication skills in French and English, analytical and critical thinking skills, ability to generate new ideas.

Work environment, terms and hosting conditions:

- 36 months, expected starting date: January 2026
- The PhD student will be affiliated to the ABIES doctoral school, employer: Université de Reims Champagne Ardenne
- The PhD student will be based in the FARE research unit (Fractionnement des AgroRessources et Environnement, joint URCA – INRAE unit), Campus Moulin de la Housse, 51100 Reims, France, <https://fare.nancy.hub.inrae.fr/> ; possibility of short stays or second part of thesis at UMR AGIR, Campus INRAE, 31320 Auzeville-Tolosane, France <https://agir.toulouse.hub.inrae.fr/>
- Thesis supervision:
 - o Thesis director : Olivier Therond (INRAE, LAE, olivier.therond@inrae.fr)
 - o Co-supervisors : Julie Constantin (INRAE, AGIR, julie.constantin@inrae.fr), Hélène Raynal (INRAE, AGIR, helene.raynal@inrae.fr), Hugues Clivot (URCA, FARE, hugues.clivot@univ-reims.fr)
- Salary: €2,300 gross per month

How to apply: please send your CV, a cover letter and some contacts for references by e-mail to olivier.therond@inrae.fr ; julie.constantin@inrae.fr ; helene.raynal@inrae.fr ; hugues.clivot@univ-reims.fr