Towards a new soil organic carbon module
for forest ecosystem models
Post-Doc position

The Ecologie, Systématique, Evolution (ESE) lab (Univ. Paris-Saclay, France) is looking for a motivated postdoc for a project focused on the **development of a new soil organic carbon module in forest ecosystem models**. Work will be performed in collaboration with researchers of laboratoire de Géologie de l'Ecole Normale Supérieure and INRAE (Lauric Cécillon, Pierre Barré, Bertrand Guenet).

Background

Increasing soil organic carbon (SOC) stocks is one of the few land management-based intervention options that has a positive and broad impact on many sustainable development objectives, including climate change mitigation and adaptation. Several international (4p1000 initiative) and national initiatives thus aim at keeping SOC stocks high and increasing SOC storage where bio-physically and economically possible. The 4p1000 France study has shown that French forest soils (i) constitute an important SOC reservoir; (ii) store SOC; but that (iii) current knowledge does not allow the identification of silvicultural practices that store SOC in addition to the observed positive trend. On the other hand, this study and a recent international synthesis show that (iv) some intensive silvicultural management practices (e.g. clear-cutting, slash harvesting) lead to SOC de-stocking. While the National Forest and Wood Program aims to increase wood harvesting in France, it is urgent to develop tools to monitor the effects of intensified silvicultural management, with the objective of preserving or strengthening the net SOC sink constituted by French forest soils.

For more than 80 years, models have been proposed to describe the dynamics of SOC. With a few exceptions, these models divide the SOC into several kinetic compartments that "empty" following first-order kinetics. This is the formalism used by the CENTURY ecosystem model, whose soil module forms the basis of the SOC dynamics module of various models reproducing primary production, such as the CASTANEA forest ecosystem model, or the ORCHIDEE land surface model. However, several studies and our consortium have shown that the soil module of the CENTURY model, or other similar models such as YASSO, fail to simulate the dynamics of organic matter in forest soils, and a re-parameterization of the soil module or even a modification of its structure is essential.

Overall aim

The successful candidate will work with the CASTANEA forest ecosystem model. He/She will (1) assess the ability of its Carbon-only and coupled Carbon-Nitrogen SOC modules to simulate the trend to increased SOC stocks in French forest soils, (2) implement in the CASTANEA forest ecosystem model an alternative, parsimonious SOC module consisting of three pools, analogous to the AMG model which has recently proved efficient in simulating the SOC trends in agricultural soils. Boundary conditions (initial SOC contents) of the AMG model can be set based on SOC partitioning performed by the Rock-Eval® thermal analysis method separating stable from labile SOC fractions.

The model will be run over more than 200 forest plots located in metropolitan France, belonging to the RENECOFOR and RMQS network, for which SOC stores have been measured at least at two sampling dates over 15-year intervals. Rock-Eval® partitioning has been performed on the RENECOFOR sites and is ongoing over the RMQS samples.

Call for proposal opened since April 1, 2021

The AMG-like module will further be implemented in the CAPSIS platform and as an R function in the soilR library.

Requirements
• Programming skills, preferably in Fortran and R, although other languages are possible
• Background in biogeochemistry / ecosystem functioning
• Interest and motivation in modeling

Selection criteria
• PhD
• Proven ability to publish papers in international journals
• Demonstrated experience working with complex codes and/or large datasets
• Autonomy, ability to work in a team and time management skills
• Experienced in multidisciplinary team-based activities with the ability to effectively communicate with colleagues and with staff from the partners of a project

What ESE can offer you
ESE is an established laboratory, representing a collaboration between Université Paris-Saclay, CNRS and AgroParisTech. ESE hosts approximately 150 researchers, engineers and administrative staff including many PhD and master's students.
Location: ESE is located in Orsay, about 20 km South from the heart of Paris, in a green area.

Contract duration: 22 months

Starting date: The position is available open from April 2021 and will remain open until filled

Salary: Competitive salary with full social and health benefits, commensurate with work experience

How to apply: Applicants should submit a complete application package by email. The application package should include (1) a curriculum vitae including a publication record, (2) statement of motivation, (3) names, addresses, phone numbers, and email addresses of at least two references.

Contacts:
Nicolas Delpierre, nicolas.delpierre@universite-paris-saclay.fr
Christophe François, christophe.francois@universite-paris-saclay.fr
Stéphane Bazot, stephane.bazot@universite-paris-saclay.fr