



18-month fixed-term contract:

Research engineer in biochemistry

– Coordinate and implement the determination of microbial nitrogen- and carbon-use efficiencies in soil –

About INRAE

The French National Research Institute for Agriculture, Food, and Environment (INRAE) is a major player globally in research and innovation on agriculture, food, and the environment. It is a community of 12,000 people with 273 research, experimental research, and support units located in 18 regional centers throughout France.

Internationally, INRAE is among the top research organizations in the agricultural and food sciences, plant, and animal sciences, as well as in ecology and environmental science. INRAE's goal is to be a key player in providing the knowledge base supporting the necessary acceleration of agricultural, food and environmental transitions, to address the major global challenges.

Working environment, missions, and activities

The recruited research engineer will be attached to the [SILVATECH platform](#) near Nancy in France, in the "Isotopy - Chemistry" team. SILVATECH comprises 14 permanent staff (research technicians and engineers). This platform is equipped with isotope mass spectrometry (IRMS) analyzers for stable isotope analysis, coupled with liquid and gas chromatography. He/she will work in collaboration with Loïc Louis and Nicolas Angeli.

The engineer will be employed by INRAE and work on the [CANETE](#) research project (2023-2027) coordinated by Gwenaëlle Lashermes of the [FARE lab](#) in Reims. This project is funded by the [FairCarbon](#) program which will determine the contribution of continental ecosystems to climate change mitigation, without which the Paris climate agreement target will be unattainable. Its objectives are to assess and predict the physiological responses of soil microorganisms to ecosystem management practices, and their consequences on the biogeochemical cycles of carbon, nitrogen, and phosphorus (e.g., carbon storage, nutrient supply for plants). The ecosystems studied include annual cropping systems, temporary grasslands, agroforestry systems, and forests, from 9 French experimental sites in different pedoclimatic contexts.

As part of the CANETE project, the engineer will coordinate the determination of nitrogen- (NUE) and carbon-use efficiencies (CUE) by soil microorganisms. These efficiencies are estimated by adding specific compounds enriched in stable isotopes (e.g., ^{15}N -labeled amino acid cocktail and ^{13}C -labeled glucose) to soil samples, then characterizing the dynamics of consumption and transformation of these compounds by microorganisms during incubation (1-2 hours).

In collaboration with the project consortium, he/she will develop the incubation method, sample management procedures, and ensure their application by participating in incubation experiments carried out in the FARE lab.

His/her main activities will be to develop and implement several techniques for the extraction and analysis of amino acids and glucose from incubation samples, within the SILVATECH platform. He/she will have to adapt protocols from the literature to:

- Extract glucose and amino acids from soils (optimization of extraction yields)
- Prepare samples prior to analysis (reconcentration/purification of extracts, derivatization of amino acids)
- Analyze the stable isotope content of nitrogen in extracted amino acid by GC-C-IRMS and of carbon in glucose by LC-IRMS (signal optimization)
- Evaluate and limit associated artifacts (extraction specificity, matrix effects) for soils with contrasting properties (texture, water content, physico-chemistry).

He/she will integrate these characterizations into NUE and CUE calculations, in addition to other analyses from incubations such as microbial biomass content and mineral carbon and nitrogen fluxes (CO_2 , NH_4^+ , NO_3^-), and will validate and interpret them.

The engineer will be responsible for drafting protocols for implementing the methods developed, and will ensure their transfer and reproducibility, by:

- Training and supervising users of the methods developed.
- Contributing to the animation and coordination of experiments.
- Making available the data acquired, and the metadata required to understand them, within the framework of the project, and then for all.

He/she will communicate on the progress of his/her work within the framework of the project, in professional networks, and by writing reports in French and English. The engineer will add value to his/her developments by contributing to publications of their results within the framework of the CANETE project.

The engineer will be supported by the surrounding teams with expertise in molecular isotopy, scientific instrumentation (IRMS), soil microbiology and biogeochemistry, as well as by the CANETE project partners.

Desired skills

Expertise

- Chemistry or Biochemistry or Biomolecules or Molecular Isotopy (one of these fields)
- Chemical analysis techniques and associated technologies.
- Mathematical and computer tools required to exploit results.
- Sample preparation techniques (biochemical extraction, derivatization, etc.)
- Health and safety regulations
- Occupational risks (chemical, electrical, radiation, microbiological, etc.)
- English language: B2 to C1 (Common European Framework of Reference for Languages)

Operational skills

- Translate research requests.
- Use IT tools to control equipment and process data.
- Use software to interpret results.
- interact with customers.
- Apply health and safety rules.
- Use bibliographic research tools.
- Communicate knowledge.
- Write technical reports.

Competencies behavioral

- Ability to organize and prioritize tasks.
- Ability to work in a team.
- Sense of responsibility/reliability.
- Analytical reasoning skills.

Contract

- Type of contract: Technical/Administrative fixed-term contract
- Contract duration: 18 months
- Hiring date: November 1, 2023
- Working hours: Full time
- Salary: Between €2400 and €2800 gross depending on experience
- Level of education required: master's degree or PhD in biogeochemistry, organic geochemistry, or microbial biochemistry.
- Desired experience: Indifferent
- Branch of professional activity: Chemical and materials sciences (BAP B)
- Job type: Chemical analysis research engineer Job type B1A41

Location

- Champenoux near Nancy
- Occasional missions of one or more days in Reims, repaid.

How to apply

Send CV, covering letter and contact details of one or two referees to Gwenaëlle Lashermes (gwenaelle.lashermes@inrae.fr) and Nicolas Angeli (nicolas.angeli@inrae.fr) before 10/09/2023. An initial review of applications will take place at the end of August.

Bibliography

Frey, S. D., Lee, J., Melillo, J. M., & Six, J. (2013). The temperature response of soil microbial efficiency and its feedback to climate. *Nature Climate Change*, 3(4), 395–398. <https://doi.org/10.1038/nclimate1796>

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