

Post-Doctoral Position

Nitrogen, Carbon and Greenhouse Gas Dynamics in Grazed Grassland

The French National Research Institute for Agriculture, Food, and the Environment (INRAE) is a public research establishment. It is a community of 12,000 people with more than 200 research units and 42 experimental units located throughout France. The institute is among the world leaders in agricultural and food sciences, plant and animal sciences, and is ranked 11th in ecology and environmental sciences. INRAE's main goal is to be a key player in the transitions needed to address major global challenges. In the face of global increase in population, climate change, scarcity of resources and decline in biodiversity, the institute develops solutions for multiperformance agriculture, high quality food and sustainable management of resources and ecosystems.

PROJECT DESCRIPTION

- Grazed grasslands represent 3.3 billion ha worldwide, i.e. 25% of the global land area, totalling two thirds of the total agricultural land area. Grasslands hold about 20% of global soil carbon stocks and may contribute to climate change mitigation through further soil carbon sequestration, but the sign and magnitude of the net greenhouse gas balance of grasslands (including CO₂, N₂O, CH₄) remains uncertain. Much depends on the frequency and intensity of management operations/disturbances such as ploughing, cutting, fertilisation and grazing. In addition, the spreading of organic manures and synthetic fertilizers and the field deposition of urine by grazing herbivores also generate emissions of gaseous ammonia (NH₃), a major atmospheric pollutant that contributes to particulate matter formation, ecosystem acidification and eutrophication, loss of biodiversity, and indirect N₂O emissions downwind of source areas.
- The impact of management on the carbon and net GHG balance of grasslands has been extensively studied, and continues to be monitored and investigated at a number of flux tower stations worldwide, but field-scale micrometeorological flux measurements are extremely sparse for NH₃. More experimental data are needed to quantify the contribution of grazing to atmospheric NH₃ pollution and to develop and parameterize NH₃ emission models adapted for the specific conditions of grazing. A better understanding of coupled ecosystem carbon and nitrogen dynamics in the soil and plant, under the forcing of herbivore nitrogen excretion and the control by meteorology, is needed not only to simulate the different NH₃ emission potentials and fluxes in the system and the net (bi-directional) exchange with the atmosphere, but also the potential for soil N₂O emissions that result from the input of labile N by grazers and fertilization. This is particularly important to address the issue of pollution swapping that may arise between NH₃ and N₂O in response to different management options.
- The main objective of this study is therefore to investigate the processes controlling NH₃ and GHG fluxes in grazed, fertilized grassland in temperate oceanic conditions. The experimental part of the work aims to provide a comprehensive dataset of the major carbon, nitrogen and greenhouse gas fluxes (CO₂, CH₄, N₂O, NH₃) measured by micrometeorological and chamber methods. The measurement setup is part of a long-term ICOS (Integrated Carbon Observation System) flux tower station in NW France, where additional intensive field campaigns will be conducted in spring and autumn 2022 to compare fluxes from two grazing treatments (full-time vs part-time grazing). The resulting data will be analyzed and used to develop, constrain and parameterize biogeochemical ecosystem models, in particular for NH₃.

WORK ENVIRONMENT AND ACTIVITIES

- Your research will be carried out at the INRAE-Institut Agro UMR SAS lab in Rennes, France. Your work will contribute to two on-going projects (EU-CCCFarming and ADEME-EMIGRAZE) aiming to better

understand and quantify GHG and NH₃ fluxes over grazed grassland. Your responsibilities include scientific research and manuscript preparation.

- You will assist with the maintenance of eddy covariance flux stations, the field deployment of several trace gas analyzers, the sampling or measurement of ancillary soil/plant variables, the logistics of intensive measurement campaigns, the processing of eddy covariance and other micrometeorological data, while conducting original research using the collected data and publishing peer-reviewed publications.

- Special terms and conditions of activity:

- The work will involve experimental activities in outdoor conditions; you must be able to conduct field work independently;
- A fully valid driver's license is required.

QUALITY OF LIFE AT INRAE

By joining our team, you will benefit from (depending on the type of contract):

- 30 days of annual leave + 15 days "Reduction of Working Time" (for a full time equivalent);
- [parenting support](#): CESU childcare allowance, leisure services;
- skills development schemes: [training](#), [career advice](#);
- [social support](#): advice and counselling, social assistance and loans;
- [holiday and leisure services](#): holiday vouchers, accommodation at preferential rates;
- [sports and cultural activities](#);
- collective catering.

TRAINING AND SKILLS REQUIRED

- **Recommended training:** You must hold a PhD in environmental science, atmospheric science, ecology or a strongly related natural science field.

- **Knowledge required:**

- A sound understanding of nitrogen and carbon processes and cycling in terrestrial ecosystems;
- Advanced knowledge of various micrometeorological and chamber trace gas flux measurement techniques, including eddy covariance, aerodynamic gradient, inverse dispersion, fast-box chambers.

- **Skills required:**

- A strong technical background, including programming skills (R, Matlab, ...) and experience with data acquisition systems and IR/laser spectroscopic trace gas analyzers (e.g. QCL);
- A proven record of scientific publications in peer-reviewed journals.

- **Experience in the following will be appreciated:**

- Surface-vegetation-atmosphere transfer (SVAT) modeling;
- Biogeochemical (grassland) ecosystem modeling.

↘ Reception modalities

- Address: INRAE-UMR SAS, 65 rue de St-Brieuc
- Postal code + City: 35042 RENNES, France
- Type of contract: post-doctoral contract
- Duration of the contract: 1 year (12 months)
- Starting date: Spring 2022
- Salary: between 28500 and 35000 EUR/year (gross) depending on post-doctoral experience.

↘ How to apply

- Send by mail to christophe.flechard@inrae.fr, in a single PDF document:
 - a 1-page cover letter explaining your motivation for applying for this position, how your prior research experience qualifies you for the job;
 - a CV, including a publication list and a description of relevant skills;
 - names and contact details for two references.