RÉPUBLIQUE FRANÇAISE
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INRAE

POSTDOC POSITION IN COMMUNITY ECOLOGY

Effects of spatial fluxes on food web architecture across coupled river-sea ecosystems

The French National Research Institute for Agriculture, Food, and the Environment (INRAE) is a public research establishment gathering a community of 12,000 people with more than 270 units including fundamental and experimental research, spread out throughout 18 regional centres in France. Internationally, INRAE is among the top research organisations in agricultural and food sciences, plant and animal sciences, as well as in ecology and environmental science. It is the world's leading research organisation specialising in agriculture, food and the environment. Faced with a growing world population, climate change, the depletion of resources and declining biodiversity, the Institute has a major role to play in providing the knowledge base supporting the necessary acceleration of agricultural, food and environmental transitions, to address the major global challenges.

Work environment

You will be primarily based at INRAE Rennes, on the campus of the Institut Agro Engineering school, under the supervision of Alain Danet (DECOD, INRAE), in close interaction with Anik Brind'Amour at IFREMER, Nantes. You will further benefit from the national (DECOD, iEES Paris, ISEM Montpellier…) and international (Sheffield University, Oxford University…) collaborators from RIVERSEA EU project, which include both theoreticians and empiricists.

You will be integrated in the DECOD research unit, which focuses on the evolutionary biology and ecology of aquatic systems along land-freshwater-sea continuum. DECOD is home to 55 researchers, 13 graduate students, and 11 postdoctoral researchers. A key feature of DECOD is its unique partnership with IFREMER, allowing it to integrate expertise across both continental and marine ecosystems. DECOD provides cutting-edge infrastructures, including access to HPC clusters (local & national), which will be essential for the computational and modelling aspects of the project.

Rennes is the vibrant capital of the Brittany region and located at 90min from Paris by train. It hosts a vibrant scientific community with 2 Universities, 9 *grandes écoles* (Institut Agro, …), 5 national research organisms (INRAE, CNRS…), and recognised for its excellence in ecology and agroecological science. The region offers dedicated support for scientists settling in Brittany.

Scientific Context

Global change and ecosystem processes transcend the artificial boundaries between land, freshwater, and sea. While these systems are intimately connected, they are often studied in isolation. The concept of meta-ecosystem science, that specifically accounts for linkages among ecosystems, has emerged as a key framework to better understand the role of species and material spatial fluxes in the dynamics of spatially distant ecosystems (Gounand et al. 2018).

We know that disrupting these fluxes–through dams or nutrient pollution–can have dramatic consequences that ripple across entire landscapes (McCann et al. 2021). However, strong empirical evidence documenting these effects on food web structure across the river-sea continuum is still lacking. Your mission will be to fill this critical gap.

RIVERSEA aims to advance our understanding of the spatial fluxes on meta-ecosystem dynamics, by combining empirical and theoretical approaches. Your research will be a crucial contribution to the project, as providing the empirical foundation to parametrize and validate cutting-edge theoretical meta-ecosystem models.

Missions

During this project, you will analyse the structure of complex food-webs across coupled river and coastal ecosystems at the catchment scale. You will investigate the similarities and differences between river and coastal food webs and the effects of water flow obstacles and nutrient enrichment on coupled river-coastal food webs. The approach is based on already existing datasets (Tableau et al. 2013; Danet et al. 2021) and on a well-tested methodology (Bonnaffé, Danet, Leclerc et al. 2024 and references therein).

Specific project aims include:

1) Build food webs (based on existing data) describing potential species interactions (down to size class level) for fish species within freshwater and coastal systems.

2) Use advanced spatial-temporal modelling techniques to analyse these food-webs along their trophic height, redundancy, connectance along their position in the river-sea continuum, and their response to the presence of water flow obstacles and the level of nutrient enrichment.

3) Publish a paper (in a major ecological journal) on the architecture of aquatic food webs along the river-sea continuum, the effects of water flow obstacles and nutrient enrichment on food web structure across coupled river and coastal ecosystems.

You will make use of extensive datasets available within our group and their collaborators. Standardized fish community monitoring over french rivers to the sea over France, sampled as part of the EU Water Directive Framework over the last decades. Environmental data such as nutrient data and dam positions are already available and used internally. Food diet data are already gathered for most part and will be completed using an internal database (AquaticWeb).

The competitive applicants have proven experience in the analysis of ecological data. Strong expertise in ecological networks and species interactions, community ecology, spatio-temporal statistical analysis (TMB in frequentist or Bayesian with INLA for example), is desired. Applicants have ideally a strong interest for ecological theory & applications for conservation.

Relevant bibliography:

Bonnaffé*, Willem, Alain Danet*, Camille Leclerc*, Victor Frossard, Eric Edeline, et Arnaud Sentis. « The Interaction between Warming and Enrichment Accelerates Food-Web Simplification in Freshwater Systems ». *Ecology Letters* 27, nº 8 (2024): e14480. https://doi.org/10.1111/ele.14480. *Equal contributions

Danet, Alain, Maud Mouchet, Willem Bonnaffé, Elisa Thébault, et Colin Fontaine. « Species Richness and Food-Web Structure Jointly Drive Community Biomass and Its Temporal Stability in Fish Communities ». *Ecology Letters* 24, nº 11 (2021): 2364-77. https://doi.org/10.1111/ele.13857.

Gounand, Isabelle, Eric Harvey, Chelsea J. Little, et Florian Altermatt. « Meta-Ecosystems 2.0: Rooting the Theory into the Field ». Trends in Ecology & Evolution 33, nº 1 (2018): 36-46. https://doi.org/10.1016/j.tree.2017.10.006.

McCann, Kevin S., Kevin Cazelles, Andrew S. MacDougall, et al. « Landscape Modification and Nutrient-Driven Instability at a Distance ». *Ecology Letters* 24, nº 3 (2021): 398-414. https://doi.org/10.1111/ele.13644.

Tableau, A., H. Drouineau, C. Delpech, et al. « A Fish-Based Index of Estuarine Ecological Quality Incorporating Information from Both Scientific Fish Survey and Experts Knowledge ». *Ecological Indicators* 32 (septembre 2013): 147-56. https://doi.org/10.1016/j.ecolind.2013.03.030.

Training and skills

Recommended training: PhD in Ecology with strong quantitative skills or PhD in Network Science with experience in Ecology

Desired knowledge:

- Conceptual: community ecology, ecological networks, Aquatic systems
- Programming: Proficiency in one or more programming languages (R, Julia, Python)
- Statistics: mixed effect models, spatio-temporal modelling
- Fluency in English (written and spoken)

Skills:

- Ability to work in a team and in an interdisciplinary environment.
- Autonomy, thoroughness and organizational skills.

INRAE's life quality

By joining our teams, you benefit from (depending on the type of contract and its duration):

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

Contract details

- Hosting unit name: DECOD
- Postal code and city workplace: Rennes (France)
- Type of contract: Fixed term contract
- Duration: 18 months
- Starting date: February 2026
- Remuneration: from ~3 560 € to 3 950 € monthly gross salary depending on professional experiences.

How to apply

Send an email to alain.danet@inrae.fr and anik.brindamour@ifremer.fr with a detailed CV, a cover letter and the names of three references to contact.

- ✓ Deadline to apply: 21/12/2025
- ✓ Interviews from the 5th to 9th of January 2026

All persons employed by or hosted at INRAE, a public research establishment, are subject to the Civil Service Code, particularly with regard to the obligation of neutrality and respect for the principle of secularism. In carrying out their functions, whether or not they are in contact with the public, they must not express their religious, philosophical or political convictions through their behaviour or by what they wear. > Find out more: *fonction publique.gouv.fr* website (in French)