

Post-doctoral position (M/W) at CEFE Montpellier, France

Predicting forests' contributions to people according to various climate change scenarios and management strategies with an integrated forest model

Starting date: December 2023/January 2024

Duration: 24 months

Location: Montpellier, France

Net income is about 2400-3000€/month depending on experience, including pension and health benefits

Overview: We hire a 24-month post doc to work on the effects of climate change and management strategies on forest contributions to people, at various spatial scales, using an integrated forest dynamic model. This post-doctoral project is part of the project FISSA - ForecastIng forest Socio-ecosystems' Sensitivity and Adaptation to climate change (ANR 2022-2026). The selected candidate will be based at the Centre d'Ecologie Fonctionnelle et Evolutive (CEFE), Montpellier, France. They will be supervised by Xavier Morin (CEFE), Nicolas Martin (URFM INRAE Avignon), Isabelle Chuine (CEFE), and Mao Zhun (AMAP INRAE Montpellier), with also interactions with other collaborators from the FISSA project.

Key words: Forest functioning and dynamic, forest contribution to people, carbon sequestration, biodiversity, forest gap models, tree hydraulic models, hydraulic failure, dynamic vegetation models, soil carbon model, species distribution models, climate change, inter-specific and intra-specific variability.

Context and objectives of the post-doctoral project

Forests are terrestrial ecosystems of major importance, and forests in metropolitan France are among the largest and most diversified ones in Europe (from Mediterranean to alpine forest ecosystems). They are complex social-ecological systems that deliver **many contributions to humans and other species** such as timber and non-timber products, carbon sequestration, bioenergy, local climate and water cycle regulation, soil fertility and habitats for biodiversity, as well as recreational areas and cultural identity. This multifunctionality can generate strong trade-offs between these contributions. Yet, like most ecosystems on Earth, French forests are increasingly impacted by on-going climate change (droughts, bio-aggressors, storms, heat stress), which alters their structure, biodiversity and functioning and threatens their renewal and carbon sink. Their sensitivity to these impacts, and by extension the sensitivity of their contributions, is expected to increase in the next decades due to more frequent and more severe droughts and heat waves, as already reported. At the same time, there is an increasing demand for the decarbonization of the French economy to reach carbon neutrality in 2050, with a strong demand for forest products and services. Regarding carbon sequestration, French forests remove up to 10-15% of national carbon emissions, thus representing a key lever for climate change mitigation, and current policies aim at increasing this value.

As a result, forest management is currently facing a key challenge: **how can we maintain or even increase forests' ability to provide wood products and sequester carbon, without impacting their other contributions, while carbon sequestration and forest mortality are already decreasing and increasing respectively?** The stakes surrounding forests have thus rarely been so high and urgent, with increasingly high expectations of society. Ambitious objectives of both national (eg. PNFB 2016-2026, PNACC 2, Plan Biodiversité) and European (Biodiversity Strategy for 2030, The 2030 Agenda for Sustainable Development, Green Deal 2020) public policies on cross-cutting issues of protection

and management also reflect these trends, although adaptation responses matching actors' expectations may be difficult to reach.

In this context, the aim of the postdoctoral project is to **test management strategies balancing all actors' expectations in order to provide robust predictions of forest's contributions** under both climate change and management scenarios. To do so, we will use a **new meta-model built from complementary process-based models of forest dynamics and functioning**, recently validated (Postic et al. unpublished), that can predict forest composition and structure, forest productivity and health, and soil carbon storage at the scale of France and for a set of forests for which particular stakes are identified. More specifically, the model is built on the coupling of the models Phenofit (process-based SDM), ForCEEPS (forest dynamics model), SurEAU (heat and water stress physiological model), and Yasso07 (soil carbon dynamics model).

More generally the FISSA project embeds interdisciplinary researchers as well as non-academic partners (such as forest managers and environmental NGOs), providing perspectives in both basic and applied science.

Using this model, the post-doc will be responsible for two tasks:

- i) Estimate forest contributions for the different sets of combination of climate and management scenarios, either directly from models output (eg. carbon storage, dead wood provision) or indirectly using dedicated analyses (eg. biodiversity habitats landscape indices, fire risk...).
- ii) Determine how climate change and management scenarios affect forest contributions, and assess synergies and conflicts between them.

The predictions will be carried out on two complementary spatial scales: national level and local sites with specific stakes and available data.

Missions

The person will be responsible for two main tasks:

- i) Estimate forest contributions for different combinations of climate and management scenarios, either directly from model results (e.g. carbon storage, deadwood supply), or indirectly using specific analyses (e.g. biodiversity habitats, landscape indices, fire risk...).
- ii) Determine how climate change and management scenarios affect forest contributions, and assess synergies and conflicts between them.

Forecasts will be made at two complementary spatial scales: the national level and local sites with specific issues and available data.

Activities

The person will therefore have to establish transfer functions between model outputs and forest contributions, and carry out simulations based on these, with possible modifications to the integrated model.

The post-doctorate will work in close collaboration with the developers/experts of the different models (I. Chuine, X. Morin, N. Martin, M. Zhun) and François de Coligny (Engineer developing the

CAPSIS platform hosting the models). Note that the project will also rely on sociological inputs from collaborators in the FISSA project, especially regarding the management scenarios to be tested. Regarding the predictions on biodiversity-related contributions, the post doc will interact with Fabien Laroche (INRAE Dynafor, Toulouse).

Working environment

Furthermore, Montpellier in general and the CEFE in particular, provide a very stimulating scientific environment, with many researchers working in ecology, evolution, agronomy and environmental sciences. The post-doc will be part of the team “FORECAST” <https://www.cefe.cnrs.fr/fr/recherche/ef/forecast>. The post-doc will be expected to coordinate collaborative research inside the FISSA project.

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Candidate profile

- PhD in Ecology, Forestry or a related subject, with a solid academic background in ecology and ecophysiology.
- Strong background in ecological modelling, programming and analytical skills in R or other languages.
- Clear communication in English in both spoken and written form.
- Good interpersonal skills needed for teamwork.

Application procedure

The application must include a cover letter (in English) explaining your interest and ability to carry out the post, a maximum of 5 publications most relevant to the project, a complete CV, and the names and contacts (email and phone number) of two academics capable of assessing your competence for this position.

Deadline: **Oct 6 2023**.

The application should be done on this page (French or English versions):

<https://emploi.cnrs.fr/Offres/CDD/UMR5175-XAVMOR-002/Default.aspx>

<https://emploi.cnrs.fr/Offres/CDD/UMR5175-XAVMOR-002/Default.aspx?lang=EN>