PhD opportunity – UMR EcoFoG & UMR AMAP

Topic

ROLE OF BIODIVERSITY ON TROPICAL FOREST RESPONSE TO CLIMATE AND ANTHROPOGENIC DISTURBANCE

Supervision and location

Main supervisor: Dr Éric Marcon (UMR EcoFoG)

Co-supervisors: Dr Géraldine Derroire (UMR EcoFoG) and Dr Claire Fortunel (UMR AMAP)

The PhD candidate will spend their time equally between UMR EcoFoG in Kourou, French Guiana and UMR AMAP in Montpellier, mainland France. They will be registered at the Doctoral School of the University of French Guiana "*Diversités, santé et développement en Amazonie*" (ED 587). The expected start date is around September/October 2019.

To apply

Please send your application as one single pdf file to Géraldine Derroire (geraldine.derroire@cirad.fr) and Claire Fortunel (claire.fortunel@ird.fr) **before March 11, 2019**. Application must include (1) a CV, (2) a cover letter expressing your interest for this position, (3) a transcript of MSc grades, (4) a written example of your recent scientific work (publication or MSc thesis), (5) name and contact information for two to three references.

Context and rationale

Tropical forests represent a key biome because of the exceptional biodiversity they host and the ecosystem services they provide (e.g. carbon sequestration, climate regulation, etc.). They are highly threatened by global changes, especially climate change and forest degradation. Understanding how tropical forests respond to these threads is crucial to assess their future, adapt management practices and ensure they will continue to provide essential ecosystem services. However, the role of biodiversity in tropical forests response to climate variation and anthropogenic disturbance remains relatively unexplored.

Recent studies have highlighted the role of biodiversity in forest dynamics and functioning [1,2]. Biotic interactions between neighboring trees depend on tree species strategies and can lead to competitive exclusion of less performant species and/or to species coexistence through niche complementarity [3]. These complex biotic interactions can influence tropical tree response to global changes. A major challenge for ecologists is to better understand the combined effects of ecological mechanisms (e.g. environmental filtering and biotic interactions) on tropical forest dynamics [4] in the context of global changes [5].

Objectives and methods

The overall objective is to develop and validate an innovative spatially-explicit modelling approach of tropical tree response to combined effects of biotic interactions with their neighbors and their abiotic environment (climate and disturbance). The model will integrate species functional traits and phylogenetic

relationships to study their role in (i) intrinsic species performance (growth, mortality), (ii) response to abiotic environment (climate and disturbance) and (iii) response to neighborhood interactions [4,6,7]. More specifically, the work will respond to two main objectives:

1. Model the combined effects of climate and biotic interactions on forest dynamics. We hypothesize that the effect of climate (e.g. duration and intensity of dry season) on tree performance changes with similarity and hierarchy with neighboring trees.
2. Assess the combined effects of anthropogenic disturbance and biotic interactions on forest dynamics. We hypothesize that disturbance intensity and time since disturbance influence biotic interactions.

The PhD candidate will develop Bayesian hierarchical models [1,4,6,7] with long-term forest monitoring data from the Paracou forest research station in French Guiana (> 30 year of annual/biennial monitoring on > 90 ha in disturbed and undisturbed plots). Functional traits data are available from previous work conducted by UMR EcoFoG and AMAP [8,9], with some additional measurement of physiological traits related to drought resistance during the course of the PhD.

Funding

Required qualifications and skills

- MSc degree in biology, ecology or statistics and modelling
- Strong skills in quantitative data analyses of large data sets using R
- High motivation and rigor
- Interest for/experience in tropical forests
- Strong writing skills
- Good level of written and spoken English, a working level in French is also desirable

References

1   Kunstler, G. *et al.* (2016) Plant functional traits have globally consistent effects on competition. *Nature* 529, 204–207

2   Liang, J. *et al.* (2016) Positive biodiversity-productivity relationship predominant in global forests. *Science (80-.).* 354, 196

3   Chesson, P. (2000) Mechanisms of maintenance of species diversity. *Annu. Rev. Ecol. Syst.* 31, 343–66

4   Fortunel, C. *et al.* (2018) Topography and neighborhood crowding can interact to shape species growth and distribution in a diverse Amazonian forest. *Ecology* 99, 2272–2283

5   Alexander, J.M. *et al.* (2015) Novel competitors shape species' responses to climate change. *Nature* 525, 515–518

6   Fortunel, C. *et al.* (2016) Functional trait differences influence neighbourhood interactions in a hyperdiverse Amazonian forest. *Ecol. Lett.* 19, 1062–1070

7   Lasky, J.R. *et al.* (2014) Trait-mediated assembly processes predict successional changes in community diversity of tropical forests. *Proc. Natl. Acad. Sci.* 111, 5616–5621

8   Baraloto, C. *et al.* (2010) Decoupled leaf and stem economics in rain forest trees. *Ecol. Lett.* 13, 1338–1347

9   Fortunel, C. *et al.* (2012) Leaf, stem and root tissue strategies across 758 Neotropical tree species. *Funct. Ecol.* 26, 1153–1161