Evidence-based synthesis of the impacts of agro-ecological transition at the global scale to support integrated modelling and decision-making

Position: Post-doctoral fellowship

Salary: 27-37 K€ (gross salary)

Duration: 18 months from 1st January/February 2021

Closing date: the position will remain open until filled by a suitable candidate.

Context

Agriculture is the largest managed biome, with potential for agro-ecological transitions to play a crucial role in sustaining biodiversity, mitigating climate change and ensuring food security. Comprehensive evidence-based information on the multi-dimensional impacts of various agricultural practices can support decision-makers select effective transition pathways. Yet, currently no such global synthesis exists despite the abundant literature on agro-ecological systems. The fragmented evidence, its heterogeneous quality, and the tendency for existing reviews to focus on singular outcomes, prevent a global overview of the potential limits and benefits of a transition to more agroecological practices.

Aims and method

We propose to systematically synthetize quantitative evidence of the effect of the main agroecological systems (e.g. agroforestry, organic agriculture, conservation agriculture) on multiple performance criteria including biodiversity (across a wide range of taxonomic and functional groups), production, nutritional and economic outcomes. Precisely, we will synthesize agroecological system performance metrics from approximately 500 meta-analyses through a novel and state-of-the-art methodological approach. Since each meta-analysis typically includes hundreds of data, this approach will allow us to synthesize a large amount of data (tens of thousands of data) from a relatively limited number of scientific papers (*Tang et al., 2013*). The proposed method considers all possible bias (e.g. heterogeneous quality of the meta-analyses, redundancy of primary studies) and precisely considers the between-study variability of the results. Three types of results are expected:
   - Quantification of system performance and environmental impacts to precisely inform decision makers from the largest evidence-based assessment ever produced;
   - Spatially explicit global biodiversity indices (e.g. affinity indices - *Gerstner et al., 2014*; Biodiversity Intactness Index – *Newbold et al, 2015,* to map the change in biodiversity when conventional agricultural practices shift towards agro-ecological ones.
   - An evidence map (Katz, et al., 2003) to guide future research.

Requirements

Applicants should hold a PhD in agronomy, ecology or associated topics and have experience in one or several of the following subjects: data mining, statistical modelling, machine learning, systematic review, meta-analyses.

Furthermore, applicants should have:
      -strong analytical skills to work with large and multiple datasets,
      -experience in scientific literature review,

-good knowledge of standard statistical methods,
-good knowledge of R,
-a proven ability to work in a team and network in an international environment.

Working environment
The 18 month-post-doc will be based at CIRAD, Baillarguet campus in Montpellier, France (https://www.cirad.fr/en/home-page), within the Hortsys lab. The job holder will be under the direct supervision of D. Beillouin. An international steering committee has been set up to train and assist the fellowship during the various stages of the work (incl. specialists in meta-analyses, statistical analyses, agronomy, ecology, and life cycle assessment). The post-doc is supported, financed and will benefit from the methodological support of the FRB, CESAB and the AgroPolis foundation (see below). The post-doc will benefit from the strong interactions between these institutions, based on regular visits to the different teams participating to the project.

How to apply
Applicants should submit a complete application package by email to Damien Beillouin (damien.beillouin@cirad.fr), which should include (1) a curriculum vitae including relevant publications, (2) a cover letter explaining your motivations for applying, and (3) names, addresses, phone numbers, and email addresses of at least two references.

Selected literature published by the team/steering committee:

Beillouin, D., Ben-Ari, T. and Makowski, D., 2019. Evidence map of crop diversification strategies at the global scale. *Environmental Research Letters*, *14*(12), p.123001.

Beillouin, D., Ben-Ari, T., Malezieux, E., Seufert, V. and Makowski, D., 2020. Benefits of crop diversification for biodiversity and ecosystem services. *bioRxiv*.

Makowski, D., Piraux, F. and Brun, F., 2019. *From Experimental Network to Meta-analysis*. Springer Netherlands.

Dainese M, Martine EA, ...Mitchell MGE, et al. (2019) A global synthesis reveals biodiversity-mediated benefits for crop production. Science Advances 5(10): eaax0121.

Chaudhary, A. and Brooks, T.M., 2018. Land use intensity-specific global characterization factors to assess product biodiversity footprints. Environmental Science & Technology, 52(9), pp.5094-5104

Jones, S. et al. (in prep) Agriculture's contribution to biodiversity conservation: a global meta-analysis.

CIRAD, the French Agricultural Research Centre for International Development, is an organization working for the sustainable development of tropical and Mediterranean regions. CIRAD's main task is to contribute to rural development in tropical and subtropical countries through research activities, experimentation, training (in France and overseas) and the dissemination of scientific and technical information. It works with more than 100 countries in Africa, Asia, the Pacific, Latin America and Europe. Its operations are conducted at its own centres and those belonging to national agricultural research systems in its partner countries. CIRAD makes its scientific and institutional expertise available to fuel public policy in those countries and the global debate on the main issues surrounding agriculture. It also supports French   scientific   diplomacy.

The **FRB** was created in 2008 and brings together public research organizations, environmental protection associations, managers of spaces and biological resources, as well as companies. The mission of the Foundation for Biodiversity Research is to support and act with research to increase and transfer knowledge on biodiversity. It is a point of convergence between science and society on the challenges facing biodiversity research today. The KBF is the French focal point of the Collaboration for Environmental Evidence (CEE), a reference organization that promotes the conduct of systematic reviews in the field of the environment, and of the European EKLIPSE2 project. The FRB now wishes to finance research through systematic reviews.

CESAB (Centre for Biodiversity Synthesis and Analysis on biodiversity) was created in 2010 by the FRB to promote high-level research activities dedicated to the synthesis of ideas and data analysis in the field of biodiversity. Located in Montpellier, CESAB offers a place and time for experts of all nationalities, under the guidance of a researcher from a French research institution, to collaborate and capitalise on existing data to answer a major scientific question. CESAB supports groups of international experts who synthesise ideas, concepts and data in order to make significant progress on the knowledge front with regard to key questions posed at all spatial or temporal scales in the general thematic field of biodiversity. The members of the CESAB groups share their expertise and pool available data to answer these questions.

Agropolis Fondation is a scientific cooperation foundation dedicated to research, training and innovation at the service of those involved in agriculture and sustainable development. Since 2011, it has carried the "Labex Agro" Laboratory of Excellence, supported by the Future Investment Programme, renewed for five years (2020-2024). It relies on a scientific network of international reputation, with more than 40 research units in five disciplinary fields: plant biology; biology of biotic interactions between plants; agronomy and management of agro-ecosystems; food and non-food transformation sciences; and human and social sciences and agriculture-society interactions. Its main mission is to promote, through its network and its multi-stakeholder and international partnership, the agro-ecological transition in tomorrow's agriculture through three federative axes, in line with international conventions: climate change: adaptation and mitigation; conservation and sustainable use of biodiversity; and responsible production and consumption.