

LIANG XU
Groningen Institute for Evolutionary Life Sciences
University of Groningen
Groningen, The Netherlands

Education

- 2015 - UNIVERSITY OF GRONINGEN
PhD candidate in Ecology and Evolution; Evolutionary models on species assemblage
- 2008 - 2010 HONG KONG UNIVERSITY
Master of Philosophy in Mathematics; Epidemic models of HIV infection
- 2004 - 2008 BEIJING NORMAL UNIVERSITY
Bachelor in Mathematics

Work Experience

- 2010 - 2015 CHONGQING UNIVERSITY OF TECHNOLOGY & SCIENCES
Lecturer in Department of Mathematics and Physics

Research Interests

A major challenge in ecology is the need for a better theoretical framework to understand how species assemblages (ecological communities) arise, why some are species-rich and others species-poor, and why some species are present or dominant whereas others are not. I am interested in how to construct theoretical models to mimic the evolutionary processes and invent efficient tools with explanatory power to ecological and evolutionary issues. The main method I take to study research questions is to construct mathematical equations to express probabilities of evolutionary states in an evolutionary process. Maximizing likelihood of models is the standard way to infer the parameters of interest. However, if models show nonlinear and high dimensional structures, preventing analytical formulation, simulation approaches are exploited to explore the behavior of the model. Furthermore, a series of likelihood-free methods (Approximate Bayesian Computation method variants) serves as an alternative tool to infer model parameters of this type.

Research Projects: Current and Planned

- 1 INFERRING LOCAL DIVERSITY-DEPENDENCE
It is still hotly debated that whether there exists ecological limit to diversity. A diversity-dependent diversification model has been developed to infer diversity-dependent signal. However, the model ignores local information. In this project, we aim to model the evolutionary processes incorporating the local details and explore that if we can still detect the local diversity-dependence.

- 2 INFERRING THE EFFECT OF SPECIES INTERACTIONS ON TRAIT EVOLUTION
Ecology and evolution jointly help to form the pattern of traits of species. We construct an eco-evolutionary model combining both ecological interaction and evolutionary history to describe how traits of species evolve under environmental stabilizing selection and species interactions.
- 3 A SPATIAL PHYLOGENETIC JANZEN-CONNELL EXTENSION TO THE NEUTRAL THEORY OF SPECIES DIVERSITY
The neutral theory of species diversity opens a new window to explain species assembly. However, the neutral assumption that all changes in distribution and abundance occur because of purely random variation in births, deaths, migration and speciation violates the recognition from decades of experiments studying hundreds of species pairs. Here, we focus on tree species and develop a spatial phylogenetic Janzen-Connell extension to the neutral theory. We aim to explore to what extent the additional mechanism indeed affects species assembly.

Research Publications

- 2018 L. Xu & R. S. Etienne. Detecting local diversity-dependence in diversification. *Evolution*, 2018 Jun;72(6):1294-1305. doi: 10.1111/evo.13482.
- 2020 L. Xu, S. van Doorn, H. Hildenbrandt and R. S. Etienne. Inferring the effect of species interactions on trait evolution. *Systematic Biology*. Under review.
- 2020 L. Xu, H. Hildenbrandt and R. S. Etienne. The spatially explicit phylogenetic Janzen-Connell effect predicts realistic macroecological and macroevolutionary patterns. *Ecology Letters*. Under review.
doi: <https://doi.org/10.22541/au.158152203.38129615>

Grant

2015 - 2019 PhD project is funded by China Scholarship Committee (CSC).

Academic Activities

- Nov, 2017 The 2017 Congress of the European Society for Evolutionary Biology: Poster presentation
- Mar, 2018 The First Conference of the Netherlands Society for Evolutionary Biology (NLSEB): Poster presentation
- Aug, 2018 Joint Congress on Evolutionary Biology: Poster presentation

Programming Skills

- R Packages: SDDD; ggradar2.
- Python ABC-SMC algorithm; Deep learning algorithm.
- Others More programming details can be found on my website: xl0418.github.io