Complexity

Special Issue on
Scales and Complexity in Ecological Communities: Models, Methods, and Predictions

CALL FOR PAPERS

Empirical patterns of biodiversity in microbial communities as well as ecological systems show remarkable regularities, which suggest the possibility that they have emerged from general underlying processes. This has attracted the attention of physicists and mathematicians who have been trying to discover and model the laws and principles of species-rich communities at different spatial and temporal scales. For instance, there is mounting evidence that critical phenomena studied in statistical mechanics are also important in biology and ecology, where scaling exponents have been discovered. Stochastic processes are crucial for explaining macropatterns. Network theory is fundamental when uncovering the relations between complexity and stability. Also, because networks dictate the rates at which resources are delivered to cells, it has been possible to develop a metabolic theory of ecology, which explains many scaling laws in biological systems starting from some physiological processes. One of the goals is to understand how microscale ecological interactions dictate self-organization and how this reverberates on the emerging complexity of community assembly at macroscale, even more so in microbial communities, where the multiscale organization of organisms influences community structure and dynamics. Theoretical physicists have been studying evolution in spatially structured environments and have successfully applied statistical mechanics to study horizontal gene transfer and growth of bacterial biofilms.

These approaches are generating a paradigm shift in theoretical ecology, which is slowly moving away from classical ecological theory, coming closer to physics. One of the main challenges is how to integrate all those disparate approaches into a coherent theory which shows how evolutionary processes generate both variation and invariance across scales of biological organization.

This special issue focuses on quantitative approaches to ecological communities, which try to dissect the connections between processes operating at different scales and the complexity of emerging patterns. We hope to attract both theoretical and data-driven works that aim at connecting empirical observations with fundamental ecological principles. We also encourage the submission of reviews which describe the current state of the art.

Potential topics include but are not limited to the following:

- Stochastic approaches to ecological systems
- Spatial models
- Evolutionary theory of ecological processes
- Applications of evolutionary game theory to ecology
- Statistical mechanics of ecosystems
- Ecological patterns
- Ecological community assembly
- Ecological scaling laws
- Allometric scaling
- Neutral theory of biodiversity
- Microbial community dynamics
- Ecology of the microbiomes
- Applications of information theory to ecology (MaxEnt)
- Effects of ecological network structure on dynamics (and back)
- Ecological networks
- Ecological interactions from abundance and/or presence data
- Stability and persistence

Authors can submit their manuscripts through the Manuscript Tracking System at https://mts.hindawi.com/submit/journals/complexity/scec/.

Papers are published upon acceptance, regardless of the Special Issue publication date.

Lead Guest Editor
Sandro Azaele, University of Leeds, Leeds, UK
s.azaele@leeds.ac.uk

Guest Editors
Jacopo Grilli, Santa Fe Institute, Santa Fe, USA
grilli.jacopo@gmail.com

Samir Suweis, University of Padova, Padova, Italy
suweis@pd.infn.it

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