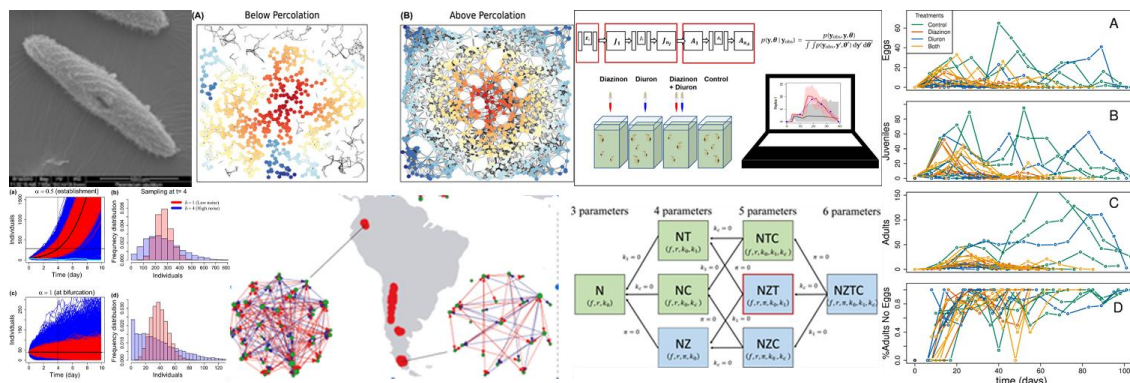


## CICLO DI SEMINARI

8 maggio 2025

### “Integrated Modelling for Integrative Ecology”

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Ecology is a discipline with flexible boundaries, where characterizing species interactions and ecosystem responses often requires accounting for the complexity, nonlinearity, and stochastic nature of biological and environmental processes.

In this talk, I will present different ecological case studies combining experimental and theoretical approaches to explore population and community dynamics under environmental stress and spatial heterogeneity. In the first part of the talk, we analyse long-term experiments on *Daphnia galeata* exposed to sublethal pesticide concentrations using a stochastic, age-structured population model. Bayesian inference reveals significant treatment effects — particularly for the insecticide Diazinon — on mortality and fertility, with clone-specific responses reflecting potential adaptation. The model also accounts for strong demographic stochasticity, supporting more reliable interpretation of ecotoxicological data. In a second case study, we develop stochastic models for multi-species systems, including food webs and metacommunities. Using continuous-time Markov processes, we revisit functional response theory, predator prey equations, and finally explore biodiversity dynamics in dynamic landscapes modelled as time-varying random geometric graphs with neutral dynamics. Among other things, our findings show that fluctuating connectivity can enhance both local and regional species richness, offering new theoretical insights into spatiotemporal drivers of biodiversity. Together, these studies demonstrate how stochastic models can reveal hidden mechanisms in ecological systems — from controlled experiments to complex landscapes.