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DISENTANGLING THE INTERACTIONS BETWEEN NEUTRAL AND NICHE PROCESSES USING THE FILTER PARADIGM

Dr Guillaume Latombe1, Professor Cang Hui2 , Professor Melodie A. McGeoch1
1Monash University, 2Stellenbosch University

The last decade has seen ongoing debate between niche and neutral theories for explaining the structure of ecological communities. The former explains the structure of communities based on environmental variables, whereas the second considers only stochastic dispersion and ecological drift to matter. It is now widely accepted that both processes interact in real communities, and most studies tend to consider niche and neutral expectations to represent two ends of a continuum, although how this continuum varies remains unclear.

We used a spatially explicit individual-based model to simulate these two processes. Applying the filter paradigm, which considers that communities are assembled by successive filtering actions of the environment, we filtered the community assembly process in two stages. The first accounted for the ability of a species to reach an empty location, i.e. the dispersal ability of the individuals (neutral).

The second accounted for the ability of a species to survive in a location (niche). We varied the
dispersal ability and the niche width of the species and simulated each process separately, and in combination (mixed model), to compare neutral, niche and mixed expectations.
Using a range of macroecological patterns we show that community outcomes often lie outside of a neutral-niche continuum. This results from positive feedback loops between neutral and niche processes. The continuum concept is therefore not an appropriate framework for understanding and modelling community assembly. Understanding how neutral and niche processes interact is crucial to predict the future of real communities, especially in the context of rapid environmental change.

Dr Guillaume Latombe is a Post-Doctoral Fellow at Monash University. He specializes in ecological modeling, with application to a wide range of topics. His current research focuses on using complexity-based approaches to understand the processes shaping plant communities.