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Explaining species diversity in a fractal world

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Multiple theoretical models seek to identify why some locations have more species than others. Our aim was to field test a new model of species organisation, the spatial scaling model (SSM) and to compare that with the stochastic niche theory and the unified neutral theory. The SSM relies on the fractal dimension (FD) to explicitly capture spatial heterogeneity in its predictions, including that species richness is a function of FD, patch size and quality. The SSM has previously been applied to systems such as rangeland herbivores and dung beetles, using existing data sets.

We tested the SSM using caddisflies that lay eggs exclusively on rocks that emerge above the water's surface (emergent rocks). Emergent rocks are a necessary resource for females to lay, with evidence that the number of eggs laid into individual riffles can limit population densities of larvae in streams. This makes it an ideal, if non-traditional, test system for model that was developed with the utilisation of food resources in mind. We surveyed 18 riffles over three rivers in south-eastern Australia, mapping every emergent rock, measuring physical characteristics of the rocks and riffles, and identifying and enumerating all caddisfly egg masses on those rocks. We found little support for the three theories tested, instead finding that species assembly was driven by within-riffle processes.