
Is the neutral theory of community ecology really neutral?

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Abstract

The Unified Neutral Theory of Biodiversity and Biogeography (Hubbell 2001) has been very influential but controversial among ecologists during the last 12 years. It relies on the assumption that biological variation among organisms does not reflect any variation in their ability to survive, reproduce and disperse (fitness equivalence), but that stochasticity in life and death events alone maintain diversity. The neutral assumption is traditionally opposed to an exclusive explanatory role of niche differences in ecology, and to the idea of natural selection in evolution. The neutral theory showed a remarkably good heuristic value to predict diversity patterns in ecosystems, despite numerous evidence of functional variation across organisms. We discuss this apparent paradox by exploring the limits of the fundamental fitness equivalence assumption. We delineate fitness equivalence so as to better assess the causality in the neutral theory. We question the extent to which apparent neutral patterns of biodiversity are possible even in presence of nonequivalence across species, insofar as stabilizing mechanisms are playing. We thereby explore two important aspects of fitness equivalence in terms of equalizing and stabilizing processes. We will then discuss the philosophical nature of the dualism in neutral and non-neutral views, and argue that spatial and temporal scales are critical aspects of the link between neutral emerging patterns and possibly non-neutral underlying processes. Therefore, the neutral theory is not as neutral as expected, and an important perspective is to assess to what extent it can be a null model in a unified framework of community dynamics.

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