

Invasion Rate versus Diversity in Population Dynamics with Catastrophes

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A key question in the current diversity crisis is how diversity has been maintained throughout evolution and how to preserve it. Modern coexistence theories suggest that a high invasion rate of rare new types is directly related to diversity. We show that adding almost any mechanism of catastrophes to a stochastic birth, death, and mutation process with limited carrying capacity induces a novel phase transition characterized by a positive invasion rate but a low diversity. In this phase, new types emerge and grow rapidly, but the resulting growth of very large types decreases diversity. This model also resolves two major drawbacks of neutral evolution models: their failure to explain balancing selection without resorting to fitness differences and the unrealistic time required for the creation of the observed large types. We test this model on a classical case of genetic polymorphism: the HLA locus.