Species extinction in large populations: contribution of climate variability and feedback

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The extinction of species is a core process that affects the diversity of life on Earth. One way of investigating the causes and consequences of extinctions is to build conceptual ecological models, and to use the dynamical outcomes of such models to provide quantitative formalization of changes to Earth's biosphere. In this paper we propose and study a conceptual resource model that describes a simple and easily understandable mechanism for resource competition, generalizes the well-known Huisman and Weissing model (1999) [1], and takes into account species self-regulation, extinctions, and time dependence of resources. We use analytical investigations and numerical simulations to study the dynamics of our model under chaotic and periodic climate variability, and show that the stochastic dynamics of our model exhibit strong dependence on initial parameters. This model is apparently the first of its kind to include a feedback mechanism coupling climate and population dynamics [2]. We also demonstrate that extinctions in our model are inevitable if an ecosystem has the maximal possible biodiversity and uses the maximal amount of resources [3]. Our conceptual modeling provides theoretical support for suggestions that non-linear processes were important during major extinction events in Earth history.

References

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